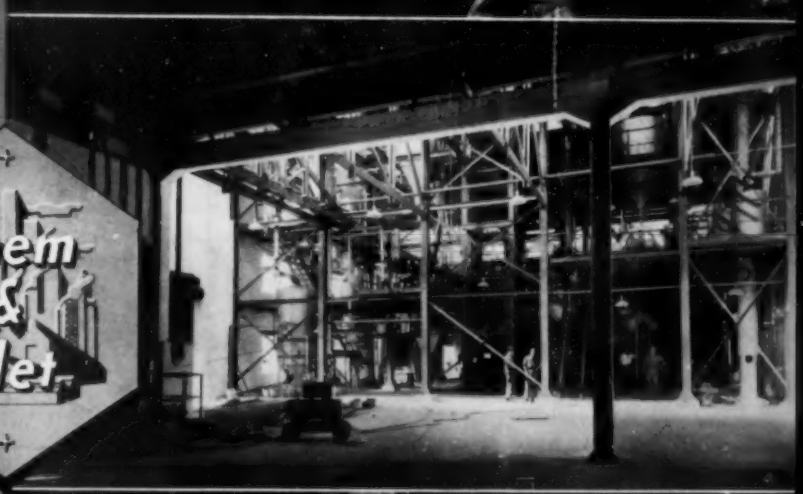
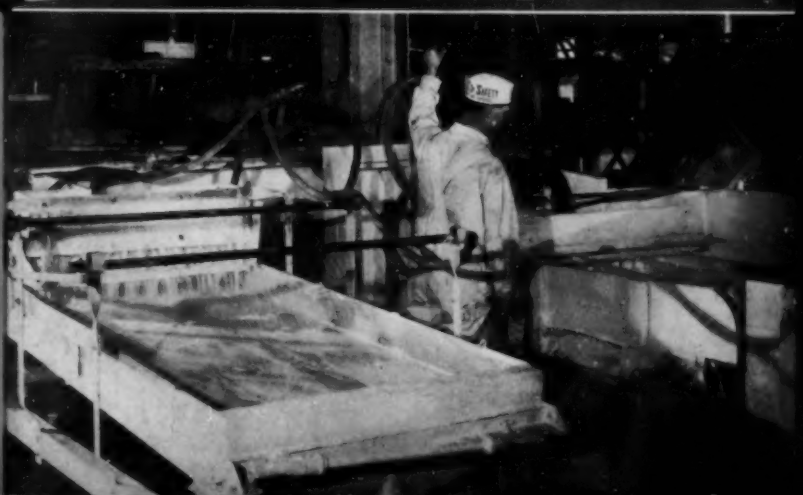
CHEMICAL & METALLURGICAL ENGINEERING





MARCH, 1943

MAINTENANCE CALLS FOR "A STITCH IN TIME"

The "how to do it" is the basis for this month's Chem & Met Report on Maintenance of Electric Lamps and Motors on pp. 117-124. In addition a plant maintenance engineer offers a program that should go a long way in keeping the wheels turning throughout the war. See the article on p. 100.

WHAT MIGHT HAVE BEEN COFFEE BECOMES A PLASTIC

Rio de Janeiro and Washington may be several thousand miles apart geographically but not industrially. Therefore, a returning American chemical engineer's report of his impressions of the Brazilian process industries and their probable future developments demands consideration by all post-war planners. See pp. 96-99.

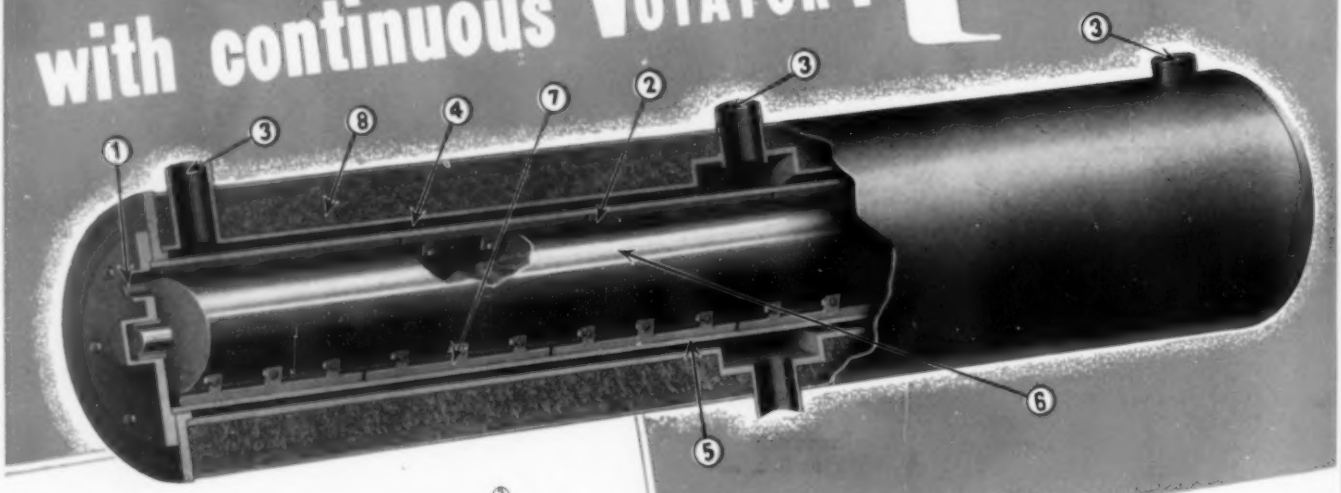
THE GREEKS HAD A WORD FOR IT,—PSIMITHIUM

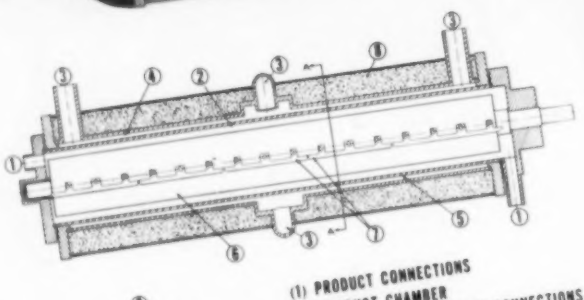
The ancient Romans too knew white lead. They called it "cerussa". In the thousands of years that have since elapsed there have been many changes in processes and equipment. Two present-day methods, Carter and Dutch, are found in the Chem & Met pictured flowsheet on pp. 130-133.

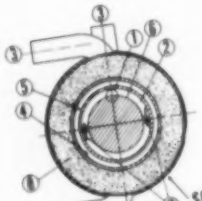
WASHINGTON NEWS pp. 139-140

Heat transfer in seconds with continuous VOTATOR!

OIL PRODUCTS
AVIATION GASOLINE
CHEMICALS, RESINS







(1) PRODUCT CONNECTIONS
(2) PRODUCT CHAMBER
(3) HEAT TRANSFER MEDIUM CONNECTIONS
(4) HEAT TRANSFER MEDIUM CHAMBER
(5) HEAT TRANSFER TUBE
(6) MUTATOR SHAFT
(7) SCRAPER BLADES
(8) INSULATION

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

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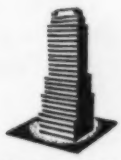

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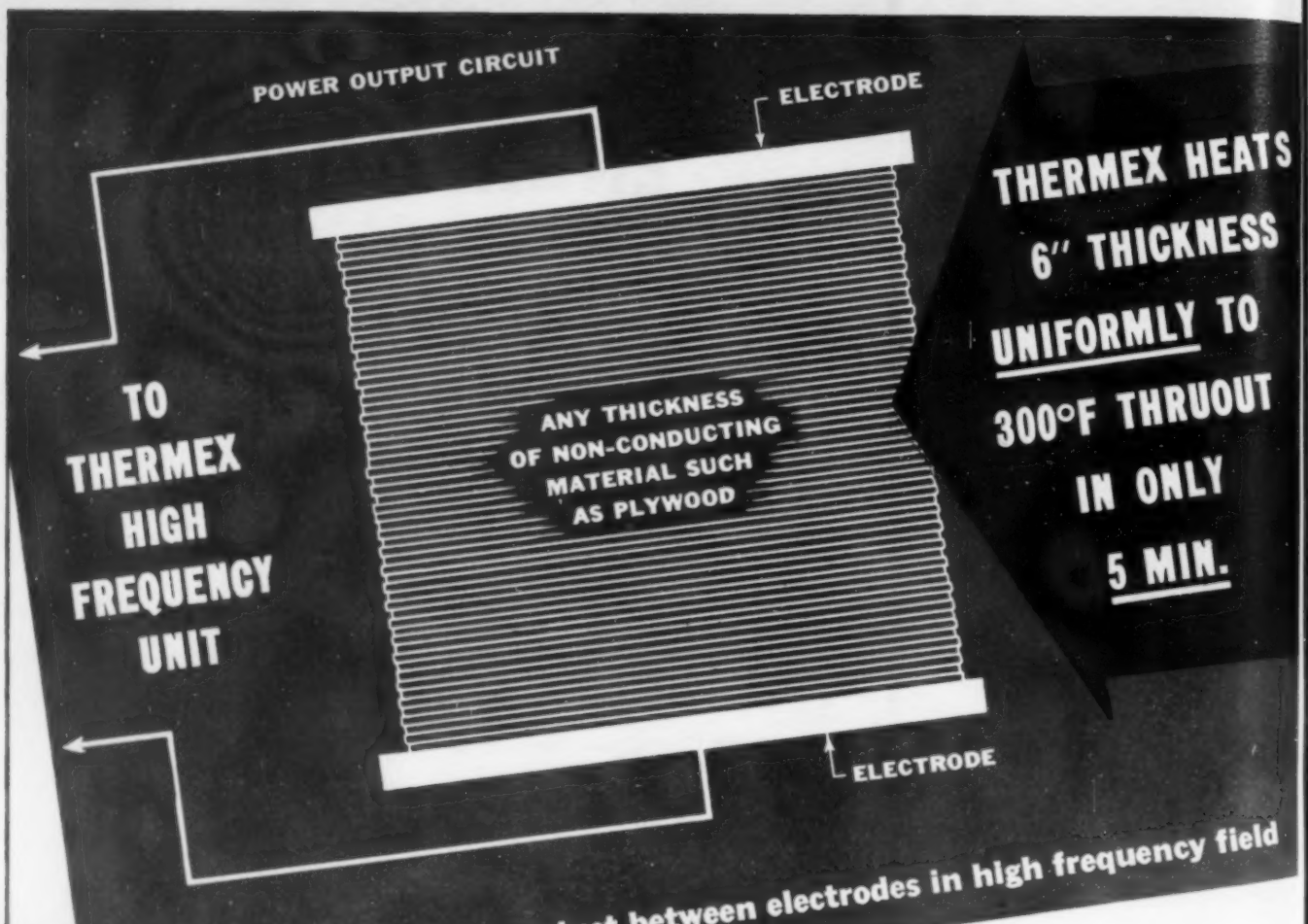
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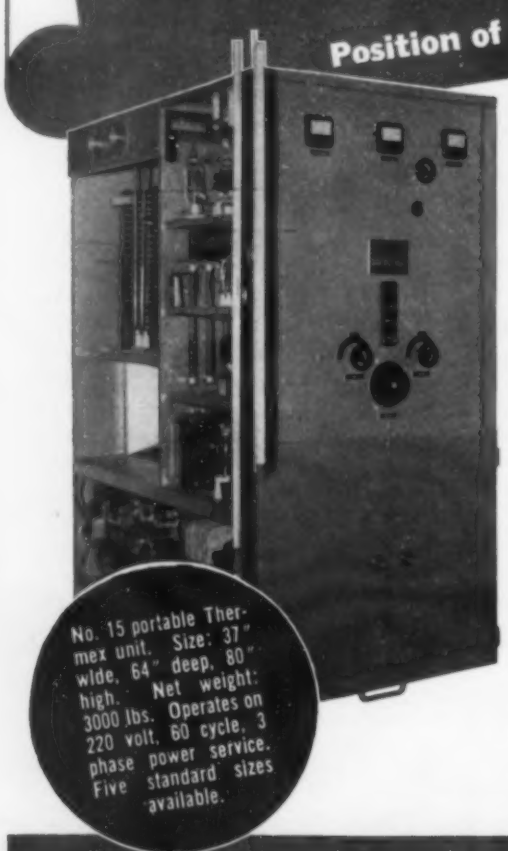

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Textiles—in War as in Peace

World's oldest industry performs modern miracles

WITH ever quickening tempo the friendly hum of the spinning wheel has echoed down the centuries—symbol of a mighty industry.

Its hum is heard today above the din of war.

Capt. Rickenbacker heard it as the lives of his party depended upon a thickness of rubberized fabric.

The hard-pressed soldier on a far-off Pacific isle hears it when he sees fresh supplies and ammunition descending from the sky via friendly parachute.

Adolf Schickelgruber hears it when winter joins forces with the enemies of his ill-clad armies and hastens the day of his defeat.

Yes, man is dependent upon textiles from the cradle to the grave – in peace and in war.

In peace man demands comfort and beauty. In war he must have comfort and protection. The textile industry is coming up to these expectations.

It is developing hundreds of special fabrics for special purposes. It has created clothing for wear, miles high in the stratosphere, and fathoms deep under the sea, clothing to meet the daytime heat of the desert and the bitter cold of its nights, clothing for the tropics and the Arctic, the swamps and mountains – for every climate and every condition.

Modern scientific warfare has forced the development of textiles that were not even thought of a year or two ago: camouflage nets; strong, light, wind-resistant Nylon tentings for the Arctic; heavy Nylon rope for glider towing; parachutes and parachute shrouds; self-sealing gas tanks; panzer hangars; cartridge and powder bag cloths; helmet linings; gas masks; fuses; canvas tops; windshield fabrics and seat upholstery for jeeps, trucks and other motorized equipment; uniforms for all armed services and for nurses, WAACS, WAVES, SPARS and MCWRS. Then there are windbreakers, raincoats, ski-troop uniforms and other items two numerous to mention. The Star Spangled Banner itself is a textile.

The Quartermaster Corps alone has issued specifications for over 300 different fabrics! Add to this the requirements of the Navy, the Air Forces, the various Civilian Defenses, the Red Cross and Lend-Lease and the sum total of textiles required for military and allied uses is approximately 70% of the total produced before the war to meet civilian requirements!

How the textile industry has been able to meet this unprecedented war demand, superimposed upon the industrial and essential civilian needs, is an inspiring story.

First, it stepped up its production to an all-time high. *Textile World's* index of textile-mill activity records three successive records for 1940, 1941 and 1942, the period covering the defense program and the first year of the war. This index for 1942 stood at twice that of an assumed "normal" year. It is noteworthy that this was accomplished mainly with existing equipment.

Second, the textile industry did a job of plant-conversion which was a masterpiece of intra-industry cooperation and idea-sharing.

Third, its technicians developed new and superior fabrics and finishes. Its engineers and production men increased the speed and the efficiency of the entire production machine.

How well all this was done becomes evident when we consider the obstacles to be overcome. Imports of critical fibres have been cut off. There is a shortage of certain chemicals and dyes. There is a high rate of turn-over in manpower and a shortage in experienced labor. It is increasingly difficult to secure machines and repair-parts – just to mention a few of the major problems.

But the textile industry delivered. It has built up an adequate reserve for our rapidly expanding armed services. It is helping to supply the armies of our allies. It is providing for our civilian population . . . all without giving the war leaders a single moment of serious worry.

Major General Edmund B. Gregory, Quartermaster

This is the ninth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

General of the United States, in special statements prepared for *Textile World*, and in addresses before textile groups, has stated that the cooperation of the textile industry has been outstanding and that the industry has kept ahead of schedule on all the major types of fabrics required.

General Gregory recently pointed out that of the approximately 234,000,000 yards of combed twill produced in this country in 1942, the Army took about 87%, the Navy 10%, leaving 3% for non-military purposes.

Col. Robert T. Stevens, of the Quartermaster Corps, in a recent address, referred to the output of duck. Production of that vital military fabric was twice doubled in six months, between January and July 1942, he said, and an annual capacity of 660,000,000 yards of all types of duck was made available. "The current rate of production of cotton duck is five times normal," said Col. Stevens, "and 38% comes from converted carpet, plush and upholstery mills. Based upon known requirements, production in this field is fully adequate".

"Fully adequate" is high praise when it refers to duck production. At the outbreak of the war it looked as if there was no possible chance of meeting requirements, at least during the first year. Nor would there have been if other types of mills had not shifted to making this fabric, and if experienced duck manufacturers had not gone "all-out" in teaching the newcomers, potential post-war competitors, everything they knew about the manufacture of duck. American industry offers many such examples of unselfish cooperation.

Another outstanding accomplishment, made necessary by the interruption of burlap imports, was the conversion of looms producing peacetime fabrics to the production of bag fabrics. The tremendous demand for sandbags, camouflage cloth, food, agricultural and other bagging, caused a conversion order to be issued for the purpose of raising the annual production rate of osnaburg from 263,500,000 yards to 660,000,000 yards, and bag sheeting from a rate of 488,000,000 yards to 855,000,000 yards. The result of this order, and of the military schedules already in effect, was to put the cotton weaving industry about 88% into war, essential industrial, and essential civilian production.

Plant conversion went on with feverish speed. Carpet looms were swung to blankets and duck; the lace industry turned to mosquito netting and insect netting of which it produced millions of yards. The flat-knitting industry with its tricot machines also is engaged in the manufacture of mosquito netting. The sewing thread industry was converted to the production of combed yarns. What once was the silk industry is now doing a tremendous amount of war work. Those mills which had equipped themselves for throwing Nylon yarns for hosiery are now throwing the Nylon for parachutes. That section of the silk industry that was equipped for weaving rayon fabrics is producing fabrics of high-tenacity rayon for flare chutes, cargo chutes and delivery chutes. Many silk and rayon looms that formerly wove clothing materials are now weaving parachute fabrics.

Today practically all Nylon is used for military purposes and the bulk of high-tenacity rayon goes into military fabrics.

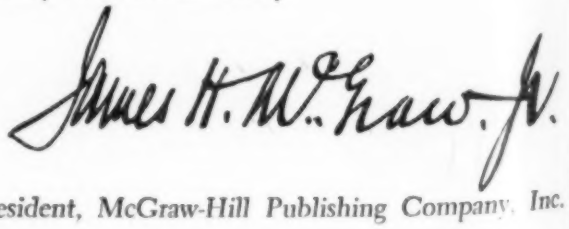
Above and beyond all the new developments is the gigantic job of producing millions of yards of standard fabrics of many colors and weaves. To produce all the uniform fabrics and blankets is in itself quite a job. The woolen and worsted industry has been doing it magnificently. Tent fabrics and summer fabrics produced by the cotton industry are no less a formidable assignment. I could point to myriad other jobs no less impressive.

The production man can indeed take pride in this record and behind the production man, the textile technician has been working tirelessly. Mildewproofing and waterproofing, so vital in a world at war, are in a new stage of effectiveness. A new process for waterproofing fabrics employs vinyl acetal plastic in place of precious rubber. Textiles that glow in the dark have been perfected for black-outs and other applications. American genius is solving problems many of which seemed insurmountable. Silk, for example, was something the Japanese thought we could never duplicate. A new synthetic textile filament that weighs but one eighth of the finest silk filament threatens to put the Japanese silkworm out of business after the war so far as we are concerned. The post-war possibilities of this development challenge the imagination.

Nor has the primary textile industry been alone in its contribution to the war. The textile machinery industry has been converted almost entirely to war work, save for a few facilities required to relieve extreme bottlenecks and supply essential maintenance and repair-parts.

Similarly, some textile mills, particularly hosiery mills hard hit by the silk and Nylon cut-off, are utilizing their space and skilled staffs to produce parts for war equipment.

The immediate significance of all this is its importance in the winning of the war. There is, however, a post-war implication which is important to the future of America. A mass production textile industry will serve civilians after the war more effectively than ever before, and will put new standards within the reach of millions. A long step has been taken toward that completely synthetic textile industry which some observers see in the future. The tempo of such changes has been accelerated tremendously. The oldest industry in the world, now one of America's largest, is showing a youth and vigor that promise much for the future ... nationally and internationally.



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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 S. D. KIRKPATRICK, *Editor*

MARCH, 1943

COUNTERFEIT CURRENCY

LIKE the bad penny that it is, the Kilgore Bill has turned up again in the present Congress. Like its predecessor (S. 2721), the revised bill (S. 702) proposes "to mobilize the scientific and technical resources of the Nation" by providing a strait-jacket of regimentation and political control that far outstrips even the Nazi war machine, after which it must have been patterned. Nowhere else, except possibly in Russia, is there any precedent for such a revolutionary proposal.

Every American industry dependent upon research, every educational institution concerned with scientific and technical training, every professional society and trade association serving the chemical process industries, every individual scientist, engineer and technologist in private or public employ should give serious study to this drastic measure and be prepared to record vigorous opposition whenever opportunity is afforded. Even though the bill may not have the slightest chance of being passed by this Congress, it represents dangerous and faulty thinking that must be corrected before it is too late to head off more serious trouble.

The new bill, in our opinion, is worse than its predecessor, if that is possible. Where S. 2721 was ostensibly concerned primarily with "breaking the bottlenecks that today choke up these technical forces" in the war effort, the 1943 model is equally concerned with the "serious impediments" to "peacetime progress and prosperity" such as "the unassembled and uncoordinated state of information concerning existing scientific and technical resources; the lack of an adequate appraisal, and the unplanned and improvident training, development and use of scientific and technical personnel, resources and facilities in relation to the national need." It notes and proposes to do something about "the consequent delay and ineffectiveness in meeting the urgent scientific and technical problems of the national defense and essential civilian needs; the trend toward monopolized control of scientific and technical data and other resources with lack of access thereto in the public interest"; and, of course, "the absence of an effective Federal organization to promote and coordinate in the national interest all scientific and technical developments."

So it sets up as its twelve major "purposes," the following curious assortment of idealistic and socialistic objectives: (1) To appraise the current use and develop a national program for the maximum application of science and technology for both peace and war. (2) To mobilize for war all scientific and technical facilities and personnel—both defined all-inclusively. (3) To facilitate transition from war economy to peacetime "enterprise." (4) To assemble, coordinate and develop for use all scientific and technical information and literature "and to aid and encourage the writing and publication thereof." (Editorial Utopia?) (5) To promote full and speedy introduction of the most advanced and effective techniques in agriculture, industry and government. (6) To aid, encourage and "protect the research and enterprise of inventors, scientists, technicians, scientific and educational institutions, research laboratories and Government establishments." (7) To discover and develop substitutes for strategic and critical materials. (8) To promote interest in scientific and technical education by providing "for all qualified persons the means of scientific and technical training and employment." (Educational Utopia?) (9) To provide guidance in technical matters to the President, the Congress and all governmental agencies and "in all proper cases, financial and other assistance to the solution of scientific and technical problems." (10) To promote and expand free (?) enterprise "by making available to smaller businesses the benefits of scientific advancement." (Sovietized technology?) (11) To standardize, when in the public interest, all scientific and technical designs, practices and specifications. (12) To establish a national scientific and technical office to assure maximum cooperation, coordination and integration of facilities and personnel.

S. 702, like the familiar slogan of a famous paint company, "covers the world." It would accomplish

all of the foregoing and other utopian objectives by establishing an independent office of the Federal Government with an appropriation of $200,000,000 (and more if necessary) headed by a $12,000 administrator, who would be assisted by a National Scientific and Technical Board of six $10,000 presidential appointees to represent industry, agriculture, labor, the consuming public, and with two additional members at large who shall be scientists or technologists. These in turn would be part of a much larger National Scientific and Technical Committee in which each of the Federal departments would be represented along with four additional representatives of the public, three more scientists and technologists and twelve additional members representing labor and management (including small business.) This committee, which is to meet not less than once a month, would advise and consult with the Administrator on all basic policies governing the administration of the Act.

Most drastic of the many powers vested in the proposed Office of Scientific and Technical Mobilization is the exclusive right to use and license others to use all inventions, patents or patent rights resulting from research or inventions to which any governmental agency has contributed since May 27, 1941 any money, credit, physical facilities or personnel. It may requisition any scientific or technical facilities needed in the war effort and also mobilize technical manpower by ordering local boards to grant the necessary occupational deferments and by prescribing rules and regulations for the "training, classification and employment of all scientific and technical personnel by any person, agency or establishment, public or private."

If anything has been left out, we have failed to discover it. As a matter of fact the weakness of the Kilgore Bill from the viewpoint of practical politics is its omnibus character. It tries to take in too much territory and in so doing is certain to stir up strong opposition from many directions. The chief danger in the measure, as we see it, is the possible creation in the lay mind of an unrealistic attitude toward science and technology and the spread of the demagogic idea that once these unknown (to the politician) forces are properly guided and coordinated, they can immediately solve all of the problems of the war and the peace that is to follow.

Some keen observers of the Washington scene believe that Senator Kilgore and his ambitious associates in the Senate Military Affairs Committee have their eyes on 1944 and a new New Deal. Perhaps they see in science and technology the building materials for a sure-fire political platform, dramatizing a new and better way to win the war and to pave the way for the miracles that will provide a postwar Utopia for everybody.

We are ourselves to blame if we do nothing to dispel such faulty notions of science and technology. The chemical industries, large and small, especially in the states of West Virginia, Missouri, Colorado and Washington, have an opportunity as well as an obligation to help in the technical education of their elected representatives in the United States Senate. Perhaps the state universities and educational institutions will be willing to lend a hand. Chemists and chemical engineers, individually and through their professional societies, must help in bringing about a better understanding of ourselves and our work. If we must be "sold" to the general public, let us make certain that it is not with the counterfeit currency of the Kilgore bill.

TO TAX IS TO DESTROY

RECENTLY a large chemical company has been told that it cannot deduct as an operating expense an expenditure of about $1,000,000 which it had made for certain research work. Apparently the Treasury officials who made this decision plan to use it for a test case. The results of this review will therefore have great importance not only for industry but for the public at large.

In this particular case the disallowed charges represent a new and considerably enlarged research program. However, the program relates definitely to a normal type of work which this company does, and the particular project is merely an extension into a field that will have postwar significance for the public as well as for this company.

If the Treasury Department can exercise its judgment as to when research is allowed as an expense, and when it is to be taxed, then we shall have a new and serious deterrent to technical progress. Conceivably, of course, there may be a few cases of tax evasion by unscrupulous firms, but there should be ways and means of punishing them without threatening the whole financial structure of industrial research. We must be careful not to kill the goose that lays the golden egg.

Responsible business executives are not going to spend money for research work merely because the spending is an expense item. They will authorize expenditures only when there is a bona fide and valuable result to be expected. And the Treasury Department must not forget that the public is always materially benefitted from successful research that makes new products available, creates new jobs and, sometimes, wholly new industries.

Just now when our research effort must be increased to prepare for postwar readjustments, it is most unfortunate to have this tax issue raised. It is to be hoped that the test case may be settled quickly, and clearly in the public interest.

GIVE THE FACTS PROMPTLY

FACTS normally regarded as trade secrets are needed by the Chemical Division of W.P.B. in order to guide efficient and fair distribution of scarce chemicals. Thus manufacturers and distributors must now ask their customers to give them the intended "end uses" for all allocated commodities in order to make sure that these chemicals are used solely for the most essential purposes.

Normally, the customer would resent such questions. But in wartime such inquiry is justified because the

government's rules require the supplier to make certain that his sales are going only for authorized purposes; and the supplier is required to report in detail on these matters. The plan is resisted by some who have sought by secret procedures to conceal certain novel methods or new products. To protect such secret procedures in wartime, however, would be taking an unfair advantage of the rationing process.

There does remain, however, a responsibility with both industry and government to safeguard with greatest care those facts which the customer regards as confidential. The good faith of all who are involved must be assured.

There has been some delay in furnishing this type of information in a few cases. As a consequence there has been some unnecessary delay in the supply of the critical chemicals themselves. Prompt furnishing of the needed facts will help both the consumers and producers. Here is where real cooperation can be mutually beneficial.

PREVENTIVE MAINTENANCE

AT A TIME when every one seems to be sniping at industry's essential needs for manpower, materials and machinery, it is comforting to find that W.P.B. has gone "all out in its effort to keep the "home front" in fighting trim. Chairman Nelson and his new production generalissimo, Charles Wilson, see eye to eye on the vital need for reestablishing sound maintenance practices, especially in those war plants where added output has been obtained at the expense of neglected equipment and manpower. That this is not merely wishful thinking is evidenced by W.P.B.'s authorization of the top priority rating of AA-1 for industrial maintenance effective with the second quarter of 1943.

Chemical manufacturers will also welcome and put to good use the two letters and enclosures that went out March 1 over the signature of Dr. D. P. Morgan as director of the Chemical Division of W.P.B. They deal with the necessity for maintaining essential production workers on the job of turning out the goods sorely needed in the war effort. They outline procedures and offer the Division's assistance in handling deferment cases that have to go beyond the local and state appeal boards. There is, of course, no guarantee of occupational deferment for any chemical worker but the very fact that the War Production Board is deeply concerned with this situation will undoubtedly help in many individual cases.

Our Washington news pages this month have more to say about priorities on materials for maintenance and repair of plant equipment. This month's *Chem. & Met.* report deals with two often neglected sources of trouble—electrical lighting and motors. Next month we tackle some of the more pressing problems of mechanical maintenance. Nothing is more important to chemical production right now than keeping our plants in AA-1 condition.

WASHINGTON HIGHLIGHTS

CHEMICAL SUPPLY has become adequate for a number of very important war chemicals so that allocation and use control is no longer required. There is even evidence that there may be so much ammonia by the end of 1943 that commercial producers will have to go out and hunt for new business. Many would-be users can renew interest in projects which have been laid aside because of shortage of raw materials. Meanwhile there has never been so great a need for alertness and flexibility to meet sudden changes toward either abundance or scarcity.

STUDENTS in chemical engineering will be scarce after the end of the present term. Army and Navy plans do not contemplate a return to college of anything like as many of these students as has been generally believed. Of the chemical engineering students who want to go back to complete their professional training, and then to take jobs in war industries based on their professional skill, only about 10 or 15 percent may be allowed to carry on in this fashion. Chemical process industries will probably get almost no graduates in chemical engineering from now on for the duration. On the whole, our engineering colleges face a very discouraging situation which mainly illustrates the fact that the military men making Washington policy have not yet learned to appreciate the engineer. Their lip service for the cause of science and technology is not supported by official action.

TEACHERS of chemical engineering, by the same token, are faced with the alternative of remaining in the universities to teach non-professional subjects or of taking jobs in process industries where their services can be better used. Ordinarily we frown on any industry that sets out intentionally to raid a college of its chemical engineering faculty. But if present trends continue, both university and industry may be better served by some temporary loans of good teachers for non-teaching industrial work.

EQUIPMENT and accessories constitute an almost complete barrier to new operations in some divisions of the process industries. Only the most essential of wartime activities can get such things as blowers and compressors, pumps and valves, pressure vessels, heat exchangers and like plant facilities. But the very fact that these things are scarce now means that production facilities will be more adequate than usual at the end of the war. A bit of postwar planning to take advantage of modern equipment is certainly essential for any company that expects to be ready for prompt readjustment at the end of hostilities.

STATE LEGISLATURES have been meeting in most parts of the country and many are still in session. With perfect sincerity, but unhandicapped by technical facts or understanding, some legislators often rush ahead on new bills that involve serious burdens for industry. Trade associations such as the Manufacturing Chemists Association do a real service for all industry in pointing out the errors in such legislation and giving constructive aid to the well-intentioned legislators. This is an important contribution but industry's responsibility does not end with the payment of its association dues. Rather, the association should be a point of contact and source of information which the responsible industrial leader will use to study and remedy the situation in his own state. By far the most effective work can usually be done at home.

Chemical Industry Advances in Brazil

CHARLES F. BONILLA *Associate Professor of Chemical Engineering, The Johns Hopkins University, Baltimore, Md.*

Chem. & Met. INTERPRETATION

By carefully mobilizing her resources and available imports, there seems to be no question but that Brazil can be of great help to the United Nations and still finish the war industrially stronger than when she entered. Chemical industry, which expanded its value of output in 1940 about 25 percent over that of 1938, is keeping step with industry as a whole. It is likely that this expanded chemical production will easily be absorbed by the Brazilian market after the war.—*Editors.*

BRAZIL, with an area roughly equal to that of the United States and a population one third as great, seems destined to have an enormous economic and industrial expansion in the years ahead. The major portion of Brazil is as yet unprospected and almost unpopulated. Most of the inhabitants are located in the seacoast states, and industry is even more localized. About 40 percent of all industrial employees live in the state of Sao Paulo, and 17 percent in the small Federal District, including the city of Rio de Janeiro. No other state exceeds seven percent of the total. The value of industrial output follows about the same geographical distribution and totals about 1.5 billion dollars ($1 = 20 Cruzeiros, or Milreis).

Brazil has been experiencing a vigorous real estate boom, but apparently this is now in the process of being superceded by an industrial boom. Many companies in the past have invested their profits in real estate, whereas now some are tending to unload their property holdings and to enlarge their plants. From 1939 to 1940 only, the number of industrial employees increased from 1,112,000 to 1,412,000. Industrial interest rates are eight percent or more.

Comparing Brazilian industry with that of the United States on a per capita basis, it is seen that the number of industrial employees in Brazil is about 10 percent as great, whereas the output of many industries is only one or two percent per capita that of the United States. Thus the output per employee probably averages about one-seventh as much. This low output is due partly to the fact that there are few large plants and little emphasis on labor saving, due to its low cost. For instance, girls in factories earn about one Cruzeiro per hour, and quite skilled manual workers may earn only three to four Cruzeiros per hour. Industry has a range of minimum wage levels from 270 Cruzeiros per month down to a third of this figure, depending on the standards of living in the particular locality.

Brazil has been ranked sixth in the world in potential hydropower, with a figure of about 20,000,000 hp., though other estimates go up to 30,000,000 hp. easy to develop and 50,000,000 hp. maximum. In coal mining countries, industry can build up first, with hydropower coming later to help out. Brazil's poor and undeveloped coal supply means that industry must follow hydropower.

ENERGY SUPPLIES

Installed hydropower totals about 1,000,000 kw. and steam-electric power some 200,000 kw. Most of the potential hydropower is conveniently located near the coast, at the edge of the large central and southern plateau. Many water power sites are available with 100,000 kw. or more within a few hundred miles of present industrial centers. Industrial energy may cost as low as 0.3 cents per kwh. in Rio itself, and 0.5 cent in other locations. The lowest contract is believed to be for 1.2 miles with an electrified railroad in Sao Paulo.

A promising long-range power and navigation site is that of the San Francisco River, where 600,000 hp. could be developed in the northeastern section of the country, and 250,000 without any dam. At the same time, this long north-south inland waterway would be opened to the sea. Some proposals advocate the complete development; others prefer 10,000 hp. at a time until full utilization.

With coal imports greatly decreased by the war, a number of substitutes are now employed. Some 1,400,000 cords of firewood were cut in 1942 for industrial fuel. Coffee beans are burned in some furnaces, such as the one in the Caffelite pilot plant. Cottonseed press cake and even corn have been burned. Some cement kilns have replaced half of their oil with ground charcoal, and others have reached 100 percent charcoal, although grinding is a difficult problem. Due to the small market for the by-products, most charcoal is made by the old, heap-burning method. Although several wood distillation plants have failed and are idle, two new pilot plants have been built, one for metallurgical charcoal and one for acetic acid for cellulose acetate.

CHEMICAL INDUSTRY

The chemical, pharmaceutical and prefumery industries, constituting one class in the statistics, contributed in 1938 some 7.6 percent of the value of all industrial production, following foodstuffs with 34.5 percent and yarns and textiles with 32 percent. Chemical expansion is approximately keeping step with that of industry as a whole, since for 1940 both expanded about 25 percent in value of output over 1938. The number of chemical plants was about two percent out of a total of 60,000. Thus, on the average, they are considerably larger than other establishments. However, for many products, the Brazilian demand is hardly sufficient to build what Americans would consider an economically sized plant. This is especially true of those chemicals at present imported.

There is the dangerous possibility that much of Brazil's chemical expansion will take place in the form of plants too small to be economical. If these were later to seek and obtain protection in the form of raised import duties, industry as a whole might

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The author was the chemical engineer of the U. S. Industrial Mission to Brazil, which has just completed, at the request of the Brazilian government a several months' study of the Brazilian industrial picture under the auspices of the Board of Economic Warfare and the U. S. State Department. Although the report of the Mission, which was under the leadership of Morris L. Cooke, is confidential, Dr. Bonilla has outlined some of his impressions in this article.—*Editors.*

suffer, having to pay the losses of these plants. As a matter of fact, it would seem that most Brazilian chemical industry is already built of just such small plants. This is probably to be expected, since the technical advances of the United States and Europe are available to countries such as Brazil before their customer demand is very high. Certain companies, for instance, are interested in introducing the manufacture of some of the most complicated synthetic products, though the scale and price would have to be unfavorable. An example of the natural tendency towards small plants is provided by the interesting set-up of Industrias Reunidas F. Matarazzo, of Sao Paulo. This, the largest chemical concern in Brazil, is made up of a multiplicity of small units, many of them housed in only one good-sized room each.

There are two corollary aspects to the small chemical output and the current boom. One is that any expanded output to further the war effort will probably be easily absorbed after the war. The other is that it is hardly possible to expand considerably the output of any chemical without also including all the raw materials. For instance, to utilize the by-products from the coke ovens at the National Steel Co. at Volta Redonda, whenever they become available, it will probably be desirable to build plants for chlorine, nitric acid, sulphuric acid, formaldehyde, and the other chemicals required.

There is a definite lack of native engineers in Brazil. Of some 300 now graduated annually, about two-thirds are civil engineers. Compared to about 15,000 for the United States, there are 1/17th as many engineers per capita. Only three of the twelve engineering schools offer chemical engineering courses, and these emphasize industrial chemistry without adequately covering equipment design or operation. Several schools offer degrees in industrial chemistry.

There is generally a lack of appreciation of industrial research and most plants have no research division. However, several government laboratories are carrying out valuable fundamental and applied research. These include the National Institute of Technology, the Laboratory of Mineral Production, and the National Institute of Oils (vegetable), all in Rio. Apparently there is no concern well equipped to carry out fundamental design on a piece of chemical equipment, starting with liquid-vapor or liquid-liquid equilibrium compositions, free energies and equilibrium and reaction rate constants.

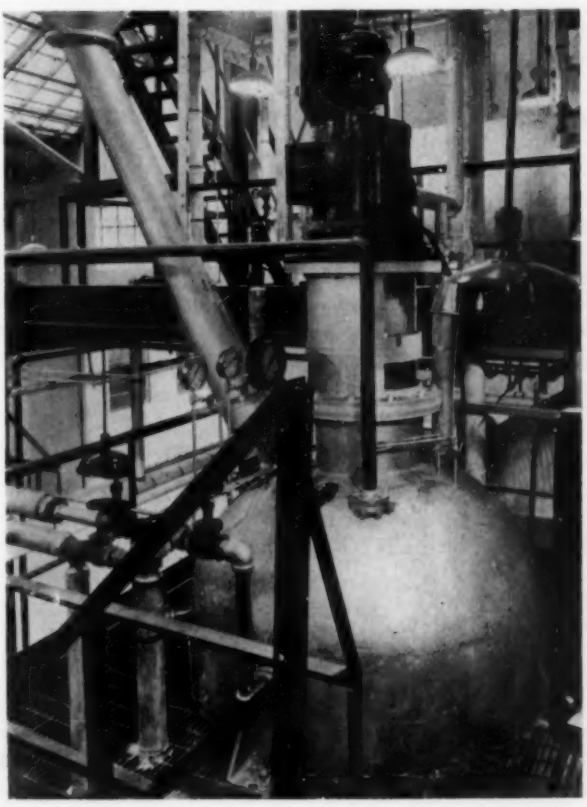
Another weakness of chemical and other industries is lack of confidence. When a piece of equipment breaks down, it is frequent for a native engineer to point at the nameplate and say: "What can you expect? It is a national product!" It is at times true that the quality of output is poor, due to the mistaken idea that selling impurity under the label of the main product is making money.

On the other hand, the quality of equipment produced is frequently excellent, though unknown to most Brazilians. For instance, Cia. Construtora de Distilarias e Instalacoes Quimicas produce complete alcohol distilleries of all types, including azeotropic dehydration with gasoline and benzene, and vapor re-use, which sell for some 50 Cruzeiros per kilo of copper ($1.14 per lb.), similar to prices in the United States. They have a capacity of some three anhydrous plants per month of 3,000-4,000 gal. daily capacity each. They have constructed small plants for ethylene from ethanol, and have rights on an extraction process (Usines de Melle, employing ethyl acetate) for concentrating acetic acid. They have not produced any petroleum refining equipment because the demand has not yet existed. Now, however, this concern would like to cooperate with some American manufacturer of such equipment, who would supply the plans.

In their latest alcohol distilleries, engineers of this concern have introduced an interesting substitution. Previous designs of 66,000 gal. storage tanks have required 11 metric tons of steel plate, costing about $1,450. Since Brazil has practically no sheet

Extensive experimental work on growth and production of rubber is carried on at the same time as the tapping. Here is a large test planting at the Brazilian Agricultural Station located at Belem

This autoclave unit at the Coffelite plant in Sao Paulo is helping to turn out several million pounds per year of coffee-derived plastic material



Rich iron ore, destined for anti-Axis furnaces, leaving Rio Doce Valley, Brazil

steel rolling mills, this was imported and now is carefully "rationed." On the other hand, copper from Chile is more readily available and can be rolled in Brazil. So now the tanks are built of reinforced concrete and lined with copper sheet 1/64 in. thick. About 0.72 metric tons of copper is required, which costs some $1,250. The concrete, at about $30 per cubic meter, raises the cost above that of the steel tank, but the result is highly satisfactory.

Use of wood for alcohol tanks and fermenters is being investigated by the Sugar & Alcohol Institute and for packed columns by the Institute of Technological Research of Sao Paulo. One little-known distillery has a wooden column. The work of the Sugar & Alcohol Institute at present is on pre-dried "peroba de campos branca" which is a heavy, hard, light-colored wood. Skoda Brasileira is also starting to fabricate complete distilleries, independent of what was originally the mother firm.

Most Brazilian engineers do not realize that glass-lined vessels up to about five feet in diameter can be made at Cia. Mecanica e Importadora, or at Fundicion Brasil, for instance, or that Maquinas Piratininga Ltda. builds hydraulic presses for vegetable oil extraction roughly equivalent to imported ones and for less than half the price. Thus, most Brazilian plant designers call for American or European presses. This company has even built a few expellers on special order.

CAUSTIC SODA AND ASH

Caustic soda is produced in one small plant with a capacity of 1,000 tons per year and by a number of smaller plants in chlorine-consuming industries. A half-dozen or so plants up to 6,000-ton size and using a variety of cells are projected, but difficulty is expected disposing of the chlorine profitably. In addition, cylinders are not available and have a slow turn-over in any case. Probably one trip every two months is the average. Muriatic acid, sodium hypochlorite, and chloride of lime will probably absorb the bulk of the chlorine.

The only cell manufacturers are Clor-Natron do Brasil, who produces a horizontal asbestos diaphragm cell with carbon anodes and tile cell lining, entirely of native materials. So far these have been designed up to 500 amp. in size and with a horizontal projected area of about 40 × 80 in. Prices for soda, except when bought through the regular distributors Duperial and U. S. Alkali Export Assn., or recognized American companies, have increased to two or three times the price before the war. Soda ash is in a similar position, except that none is produced in Brazil. The combined previous imports of caustic and soda ash would just about take the output of one 200-ton-a-day Solvay plant, and it seems likely that some such plant will be constructed eventually, especially since the government has a committee working on the problem. This is about the lower limit of economical size for a soda ash plant, and there are units ten times this size in the United States.

There are excellent rock salt deposits in Brazil, but they are in the northeastern section of the country. Solar salt production (regulated at 600,000 metric tons for the year) also largely centers there, but there are no railroads connecting the "hump" with the southern industrial area.

SULPHURIC ACID

The sulphuric acid industry includes some dozen plants with a capacity of 60,000 tons per year. One of the plants burns zinc pyrites, which are later leached for a one-ton-per-day electrowinning plant which is to be doubled in size. Two plants burn native pyrites, but the rest require Chilean or American sulphur, and frequently pay high prices. Brazilian pyrites deposits are largely unprospected, and the high sulphur content, about seven percent, is not yet being recovered in any usable form. It seems likely that when coal for the new steel plant is washed in larger amounts, sulphur in some form will be recovered.

An interesting aspect of the industry is that most of the sulphuric acid manufacturers evidently prefer to import sulphur rather than to develop their own pyrites. Brazilian companies having high process steam requirements, however, are showing interest in pyrites, burned in a Nichols flash roaster, on account of the fuel shortage. There is a good possibility for Brazil in the absorption of sulphur dioxide from gases of furnaces burning the high-sulphur coal. A good portion of the sulphur imports have previously gone to carbon disulphide to be used as an ant killer.

ALCOHOL INDUSTRY

The alcohol industry is well developed, principally on account of previous years of sugar overproduction, which were followed by the creation of the Sugar and Alcohol Institute to control production. Addition of anhydrous alcohol to imported gasoline has, until recently, not equaled the statutory requirement, but has merely used up the excess sugar crop. In 1941, 162,000,000 gal. of gasoline were consumed in automobiles, as well as 27,000,000 gal. of 95 percent or anhydrous alcohol. The alcohol was burned alone in some states. In others in which blends were used, these averaged 22 percent alcohol. Anhydrous alcohol sells for about seven cents per liter, or 27 cents per gal. The power obtained is about the same as with gasoline, but the miles per gallon are only about 60 percent as great in the usual engine. High compression engines raise the figure to about 87 percent. One-half to two percent of glycerine is added by some drivers to their alcohol, castor oil to anhydrous ethanol by others, to improve cylinder lubrication. Where straight alcohol is used, 95 percent is frequently preferred to anhydrous, due to easier starting. Some gasoline

is added at times to facilitate starting with alcohol but, in general, nothing is required in the climate of Brazil.

Alcohol capacity of the country is continually increasing and is now in the neighborhood of 180,000 gal. of anhydrous per day and an equal amount of 95 percent. However, these plants only average about 150 days of operation per year, paralleling the sugar cane season. It was recently announced that 30 percent of the rum produced was to be distilled to 95 percent for fuel, which would add some 7,500,000 gal.

A great many small plants are involved in the alcohol picture. The largest has a capacity of 16,000 gal. per day, about one-fifth the size of the present largest American plant. One pilot plant is in operation on butyl fermentation of corn, but the demand for butanol and acetone is not great. Several distilleries are now in operation with ground manioc root, which is high in starch and easy to grow and store. More manioc will become available, as it is to be used in decreasing quantities in bread during 1943. In spite of the large alcohol industry, there seems to be practically no production of derivatives except ether. Acetic acid is one of the imported chemicals on which the "black market" price has increased considerably.

Brazil yields innumerable vegetable products which she used to export for processing abroad. At present this is more difficult, and the Commodity Credit Corporation, for instance, has purchased large parts of the coffee and cocoa bean crops for storage in Brazil until a more propitious time. Babassu, castor, oiticica, and many other oils from beans, palm kernals and nuts will probably be processed more and more within Brazil.

There is considerable soap production, but very little of the glycerine is recovered. This seems to be due to a small peace-time demand, as a result of which Brazilians cannot economically justify installing recovery equipment now (assuming it would be available) at ceiling prices in the United States. Brazil might eventualy become one of the world's main soap-producing centers.

Brazil may easily become the caffeine and theobromine center of the world, with her large stocks of excess coffee and unavoidable production of "hard" coffee, the fraction that is rejected as unsuitable for beverage purposes. There is also cocoa press cake, and possibilities in mate. Several small-scale manufacturers produce theobromine and caffeine from cocoa in Brazil. One, Cia. Organoquimica, has recently expanded to a capacity of 200 tons per year. The Monsanto Chemical Co. is now constructing a small plant.

American companies operating plants in Brazil include General Motors, Ford, Armour, Wilson, Swift, Johnson & Johnson, Bates Valve Bag Corp., Prest-O-Lite, Goodyear, Firestone, Hobart-Dayton, General Electric, du Pont (part interest in "Duperial"), Esso, International Harvester and Ferro-enamel. These operate, in general, for the local market. In spite of past measures which have been repressive towards the expansion of foreign participation in certain industries, the present attitude seems definitely to encourage the introduction of American technique and new processes.

LEGAL RESTRICTIONS

The two bodies of law that govern foreign industrial activity in Brazil are the Constitution and the Code of Mines. According to the Constitution, every company must have at least two-thirds of the employees in each technical grade as Brazilian citizens and at least two-thirds of the wages or salaries in each grade must go to Brazilians. These restrictions are removed if sufficient Brazilians are not available for the grade.

It is permissible for any company to have less than 50 percent foreign capital but for 50 to 100 percent, special permission must be granted by the government. The Code of Mines places further restrictions on industries which "use minerals of native origin," although they may be waived by the President upon special appeal. The Code of Mines states that only companies which are 100 percent Brazilian owned may "industrialize" a raw material that is a mineral. The Code has been interpreted by the courts, in the two cases that have so far come up, to mean that only a Brazilian company may process a raw material to the point where it first becomes a recognized commercial material. Specifically, it was found in one case that while only a 100 percent native company may mine bauxite and purify it, a foreign company might purchase purified alumina and make aluminum. In the other case, it was found that blast furnaces could not be totally nor partially owned by foreigners, but that pig iron and steel ingots could be purchased and further processed by them.

An interesting and important case would be that of industrial salt and brine. Presumably, a foreign caustic plant could operate with sea water or sea salt, as this is not a mineral. It could probably also use salt that had been brought up from underground and crystallized by a Brazilian company. It could apparently not operate directly with rock salt brine, as brine is not a recognized commercial product commonly bought and sold. A foreign Solvay soda plant similarly could operate with sea shells, or it could buy lime from a Brazilian company, but it could not calcine its own limestone. It would seem that foreign participation in a chemical industry based on Brazilian petroleum would also be barred, except for special action.

On September 28, 1942, a few days after the arrival in Rio de Janerio of the U. S. Industrial Mission, economic and industrial mobilization was decreed by President Vargas. Minister Joao Alberto Lins de Barros was appointed Coordinator to head this important activity. Since then, Minister Joao Alberto has created a Department of Industrial Production. This office is under Dr. Ari F. Torres, Professor of Civil Engineering of the Polytechnic School of Sao Paulo, and recent ex-director of its Institute of Technological Researches. He will be remembered by many as having supervised the transfer to Brazil of the Hopewell, Va. nitrocellulose rayon plant of the Tubize Chatillon Corp.

Salt beds at Cabo Frio (Cold Cape) in the State of Rio de Janeiro

Maintenance in Wartime And After

J. L. BOWMAN *Philadelphia Works, E. I. Du Pont de Nemours & Co.*

Chem. & Met. INTERPRETATION

Here is a program for the maintenance of a plant that should go a long way in keeping the wheels turning throughout the emergency. Foresight and ingenuity displayed at this time will dictate the success attendant upon a smooth process of conversion to peacetime production in a minimum of time.—*Editors.*

PLANT MAINTENANCE has become increasingly difficult as the tempo of war production has been intensified. Scarcity of materials and priority limitations added to the problem of skilled mechanic shortage have introduced a problem of the first magnitude to the average maintenance engineer.

His problem has been further influenced by management's endorsement and support of the government's "Get out the Scrap Campaign." The old practice of laying aside certain used materials and equipment parts which have been dismantled under project improvements, etc., and stored against the time when they may be of value to meet emergencies has been completely upset.

A prominent member of the War Production Board has analyzed the problem, and his appreciation of the difficulties and solution to meet the current situation are summed up in his terse slogan of "Patch and Pray." This admonition may be justified up to a certain point, but it would be extremely unwise to carry out this policy literally as a cardinal principle of plant maintenance for the duration of the war. The net results might not be discernible for some little time in the future, but the day of reckoning would inevitably follow in due course and the premium paid would be staggering.

It is essential that a forward looking viewpoint be taken of the problem of maintaining our plants and factories at this time. Industry, like the average person, is eagerly hoping for the end of this war. Already plans are underway to be put into immediate effect when hostilities cease and planning for speedy reconstruction to meet normal peacetime production needs is being studied.

In view of the postwar economic status of the world and the physical reconstruction necessary in devasted areas, the world will look to American industry to supply the desperately needed materials and all classes of consumer goods.

We must be ready at all costs to meet this challenge and meet it with as little delay as possible. This can only be accomplished if our plants and factories are reasonably maintained now and for the duration of the war. If through a general policy of "Patch and Pray," we find that a period of rehabilitation is necessary after the war, the onus of responsibiblity for delays and crushing expense must of necessity fall upon the maintenance engineer for lack of foresight, ingenuity, planning and initiative.

This war has opened the eyes of the average man and community to certain factors in our national life which we have taken for granted as specifically essential to our well-being. Pursuit of certain phases and comforts in life which we have enjoyed over a prolonged period of years has mentally converted some of our amenities to the status of actual necessities. Our experience in this war emergency is proving that we can get along reasonably well with less, and that we have been prodigal and even wasteful in many respects.

This would appear to be true of our industrial problems also, and it is probable that many of the present so-called difficulties which we are facing in industrial maintenance are only relative to the degree of our prodigality for many years prior to the outbreak of war.

Of course the position of maintenance engineer today entails harder work, better planning, greater ingenuity than in times of peace, but I cannot conceive that the task of maintaining plants and factories even under war time restrictions will transcend the capacity and ability of the trained engineer.

The problem involves several specific measures which must be carefully followed in order to provide uniformly a certain standard of maintenance for the duration of the war. If these standards are maintained, one of the major problems of a speedy conversion to normal peacetime production will be automatically taken care of. If on the other hand plants and factories are maintained on the so-called "Patch and Pray" standard, it is logical to affirm that much delay, heavy expense and dislocation of production will take place before peacetime production lines will function economically and efficiently.

To the maintenance engineer who is faced with added responsibility by reason of war conditions and the shutting of many doors which were open in normal times, and who at the same time, realizes that his plant or factory must not be allowed to deteriorate or become run down despite present difficulties, the following points are suggested for his consideration as an aid for the present and a protection against postwar dislocation.

(1) Conserve present facilities by careful schedules of preventive maintenance; set up a systematic inspection service to detect where repairs will prolong the life of equipment before excessive wear has made major repairs or replacements necessary. The expense incidental with such inspections is a sound economic investment for inspections will ensure long continuous periods of production.

(2) Give special attention to lubricating schedules—poor or improper lubrication of equipment causes more breakdowns and interruptions to production than any other controllable factor in maintenance and repairs. If possible, assign a competent member of the mechanical staff to supervise this work in order to ensure that the schedules are actually being followed out uniformly. Records of schedule performance should be submitted to the engineer in charge of maintenance at predetermined intervals.

(3) Where critical materials are mandatory for replacements, the approximate maximum life of existing facilities should be determined beforehand. By so doing replacement parts can be put on order under AA-1 priority rating in reasonable time to ensure deliveries

(*Continued on page* 115)

Insecticide Chemicals Needed For War Food Supply

R. S. McBRIDE *Editorial Consultant, Washington, D. C.*

Chem. & Met. INTERPRETATION

With the unusual importance of reaching fully all crop goals set, it is very necessary that the maximum practical insecticide supply be prepared and used. Many divisions of the chemical industries are involved, in addition to those which supply arsenic, copper and the other toxic agents. Review of the whole situation is important for alkali, acid and many other chemical makers. A factual background for such review is here provided by an editorial interpretation of official and semi-official data.—*Editors.*

INSECT control by chemical insecticides is of extreme importance this year. Shortage of raw materials makes necessary a careful appraisal of the situation from the point of view of the chemical manufacturers. Because of limited interchangeability among insecticides the problems of one division of the industry become the problems of all.

Protection of crops from insects may be accomplished by killing or repelling the pests. The substances used in chemical control are classified as follows:

1. Stomach insecticides—Sprays or dusts placed on or mixed with the food of insects, which kill when the poisoned food is consumed.
2. Contact insecticides—Sprays, dusts, or dips that kill insects when applied to the surface of their bodies.
3. Fumigants—Chemicals used in the form of a gas within an enclosure of some kind or in the soil.
4. Repellents—Substances which keep insects away from crops and animals.

Chemical planning as it relates to insecticides requires particular attention to the crop problems which are involved. It is extremely important for each maker of raw materials used in insecticide manufacture to know how changes in crop programs affect the need for his particular raw materials.

Regardless of the type of chemical desired or the type of attack on the insects which is most effective, the important consideration is to get the necessary supply of chemicals to insure insect control for every essential crop. The degree to which insecticides will be used this year seems very generally to be limited by the supply of chemical raw materials. Unfortunately, at a time when unlimited supply of insecticides is most desirable, it has become necessary for the government to impose allocations and restrictions particularly on luxury uses and less essential crops. Plans are necessarily organized according to the chemical raw material which is the essential or limiting component.

ARSENICAL SUPPLIES

Perhaps the most universally useful insecticides are those based on the toxic action of arsenic. All of these compounds are made by some formulation from the primary ingredient white arsenic, or arsenic trioxide.

There is abundant capacity for manufacturing of lead arsenate, calcium arsenate, and other arsenicals. Officials of the War Production Board and the Department of Agriculture have, therefore, taken steps to bring in marginal producers and start new production in order to increase the raw material supply. Minimum requirements in terms of white arsenic this year indicate military demands substantially in excess of the total expected supply for insecticides to be used either domestically or for export to our Allies. If agriculture gets the hoped for 26,500 tons of As_2O_3 to make insecticides it is anticipated that the following arsenical products will be manufactured:

	Quantity (1,000 lb.)	As_2O_3 Equivalent (tons)
Calcium arsenate..	90,000	16,300
Lead arsenate....	57,000	8,100
Paris green.....	4,000	1,100
London purple....	1,500	300
Other arsenicals...	2,500	700
	155,000	26,500

Various arsenic chemicals can be used to a limited extent interchangably. In fact, it is difficult to state just what is the present demand for each. The fact that there is a shortage of one insecticide usually creates abnormal demand for all other potential substitutes. Farmers are so dependent on crop protection in order to protect their other expenditures that it is difficult at any time to identify exactly the preferred insecticide. This is especially true at this time.

Much more significant are the actual consumption figures in the crop year 1941. The accompanying table shows for the major arsenic chemicals the extent to which each type of crop was served. These figures afford an excellent basis on which chemicals makers can judge some of the changes of the future as modified agricultural programs are formulated by the government.

CRYOLITE

If adequate supplies of either natural or synthetic cryolite can be made available, domestic users of this insecticide probably might apply 12 to 15 million lb. per year for pest control. Apple growers in the Pacific

Major Uses of Arsenicals in U. S. Agriculture During 1941

Millions of Pounds

Calcium arsenate	
Cotton	55.0
Potatoes	19.0
Tomatoes	7.5
Vegetables	1.5
Fruit crops	0.7
Government programs	0.5
	75.2
Paris green	
Cotton	2.0
Home gardens	1.0
Potatoes	0.5
Tobacco	0.35
Mosquito control	0.15
	4.0
London purple	
Cotton	1.0
Home gardens	0.4
	1.4
Lead arsenate	
Apples	35.0
Other fruits and nuts	8.7
Home gardens	5.8
Trees and grass	5.0
Vegetables and tobacco	2.8
Cotton	1.5
Government programs	4.0
	62.8
White arsenic	
Weed killer	13.5
Livestock dips	1.5
Hopper and cricket control	0.2
	15.2

Northwest are the major users, employing cryolite as a supplement to the essential arsenicals.

Practically all cryolite is used by dusting, in the form of a very fine ground product. It can not be applied to apple orchards with the same equipment as is used for spraying of liquid arsenicals. There remains, therefore, a question as to the capacity of dusting equipment in existence in the orchard areas to utilize increased cryolite insecticide if produced.

COPPER CHEMICALS

The quantity of copper chemicals made and consumed in pest control will depend largely on the quantity of scrap copper which can be spared for their manufacture. Over 200 million lb. of copper chemicals, principally copper sulphate, are wanted for military use, for export, for other industries, and for insecticides. It is probable, however, that the actual supply for all these purposes will not exceed 160 million lb.

What are characterized as "minimum needs for domestic agriculture" for 1943 are the following quantities: Copper sulphate, 80 million lb.; copper carbonate, 2.5 million lb.; and copper oxides, about 1 million lb. The major crop uses included in this estimate are potatoes, 35 million lb.; apples, 18 million lb.; other fruits, 15 million lb.; and soil amendment, 5 million lb. Minor crop demands account for the balance.

NICOTINE SULPHATE

Tobacco waste and low-grade leaf tobacco normally supply about 2 million lb. of nicotine sulphate per year. An additional 1.8 million lb. is expected this year by diversion, under a government subsidy program, of about 25 million lb. of leaf tobacco to this job of byproduct making.

The new supply, with the stock on hand at the beginning of the year, will give agriculture nearly 5 million lb. of nicotine sulphate, which is 40 percent nicotine equivalent. This product, ineffective against some insects, is experiencing an unusual demand, particularly for aphid control on many crops.

It is expected that insecticides for domestic crops will account for about two-thirds of the total available maximum supply, with use principally for apples, home gardens, grapes, and cabbage and other cole crops. Substantial exports under Lend Lease and through commercial channels will take most of the rest of available supplies.

CONTACT INSECTICIDES

The two major components of fly spray and similar contact insecticides are pyrethrum and rotenone. A combination of these two ingredients has been found to be better than either alone for many such products as insect spray. The active components of pyrethrum, called pyrethrins I and II, give a quick "knock down," but not a satisfactory "kill." Rotenone, on the contrary, has high killing power but does not act as quickly. Hence, to get the benefit of both immediate elimination and a large percentage kill, one normally uses in a spray a combination of the two components. However, because of wartime shortages such a combination is not permitted under Conservation Order M-133.

Pyrethrum flowers grow on a type of daisy which has been cultivated extensively in Japan. British East Africa is now the important source of these dried flower heads, either as powder or extract. Expansion of the East African supplies has been attempted; but there have been delays in bringing much new land

Supply and Consumption of Insecticides

(Statistics for 1939 unless otherwise indicated. Pounds

Material	Supplies: Domestic Production	Supplies: Imports	Agricultural Requirements Estimated Domestic Consumption for Insecticidal, etc., Use: 1939	1942 (Oct. 1 to Sept. 30)	1943
Antimony compounds:					
Barium antimony tartrate	confidential	N.S.	20,000	20,000	
Tartar emetic *	confidential	N.S.	100,000	110,000	110,000
* (Requires 40,106 lbs. of antimony or 0.3% of total antimony used by chemical industry and 61,974 lbs of potassium bitartrate or 1.6% of total potassium bitartrate domestically produced in 1939. Theoretical basis).					
Arsenicals:					
Calcium arsenate	39,281,788	1,627,193	75,209,000 (1941)		89,900,000
Lead arsenate	59,568,596	11,557	62,885,000 (1941)		57,132,000
Paris green	2,040,307	45,823	4,000,000 (1941)		5,605,000
Sodium arsenite (includes 14 million for weed killer).	N.D.	N.S.	15,500,000	15,500,000	0
White arsenic (crude & refined) (1940).	49,966,000	19,858,000	1,670,000 (1941)		1,860,000
Benzene, gal. 1940 (includes 110 million as motor benzol).	148,378,417	2,785,555	10,000	10,000	
Benzene, paradichloro — (1940)	15,096,726	N.S.	2,500,000	2,500,000	
Borax (boron minerals) (1940)	486,710,000	752	100,000	100,000	
Boric acid	34,696,000	1,922	25,000	25,000	
Chlorine (exclusive of pulp industry) Includes hypochlorites and chloramine T.	971,108,000	.....	7,000,000	8,000,000	.....
Copper fungicides:					
Bordeaux mixture (see Copper sulphate).					
Copper carbonate	605,101	N.S.	2,500,000 (1941)		2,500,000
Copper oxide (red and yellow)	N.D.	600	1,114,000 (1941)		3,000,000
Copper sulphate, hydrous (1940). Includes sulphate used in production of other Cu salts.	134,031,827	N.S.	51,122,000	79,539,000	86,000,000
Cresylic acid and tar acids (1940).			3,200,000	3,200,000	
o-Cresols	1,329,199				
o-m-p-Cresols	16,049,525				
Cresylic acid (refined)	18,371,261				
Fluorine compounds:					
Cryolite (1940)	None	57,921,920	5,000,000	5,000,000	6,600,000
Sodium fluoride	7,711,000	N.S.	800,000	1,200,000	1,700,000
Sodium acid fluoride	N.D.	N.S.	N.D.	27,500	
Sodium fluosilicate	12,886,000	6,672,492		2,000,000	
Formaldehyde (40% soln.) (1940).	180,884,573	Small amount	1,850,000	1,700,000	
Fumigants:					
Carbon disulphide	161,523,747	N.S.		2,500,000	
Carbon tetrachloride (1940)	100,811,330	N.S.	3,000,000	6,000,000	
Chloropicrin	N.D.	N.S.	100,000	100,000	
Ethylene dichloride	confidential	N.S.	5,000,000	6,000,000	
Ethylene oxide	confidential	N.S.	100,000	100,000	
Hydrocyanic acid, liquid (1940).			2,000,000	3,000,000	
Sodium cyanide	N.D.	50,410,497	Used, in part, for manufacture of hydrocyanic acid		
Potassium cyanide	N.D.	20,176			
The imports of sodium and potassium cyanides are equivalent to 20 million lbs. hydrocyanic acid (theoretical basis).					
Calcium cyanide	N.D.	N.S.	105,000	200,000	
Methyl bromide	confidential	N.S.	200,000	400,000	
Trichloroethylene	confidential	905,484		50,000	
Geraniol (1940)	306,435	N.S.	25,000	25,000	
Mercury compounds:			Mercury content (1)		
Calomel (mercuric and mercurous chlorides).	643,253	7,150	16,900	16,900	5,000
Blue ointment (mercury) (1940).	2,871,052	12,971		10,800	0
Mercuric chloride (see Calomel).	N.D.	300	59,100	59,100	59,100
Organic mercury seed disinfectants				95,000	95,000
Yellow oxide of mercury				926	926
(1) Total mercury requirements, 118,800 lbs. or 5½% of available domestic supply.					
Naphthalene, crude and 78% (1940)	227,277,000	6,290,380		850,000	
Metaldehyde				108,000	200,000

into production, a shortage of skilled supervisors, and (significant for the United States) a prior claim of the British on part of the supplies. It had been hoped that a total production of perhaps 20 million lb. would be possible, but it is now doubtful if imports will exceed 12 million lb. for this fiscal year.

Pyretnrum is important as a delousing agent and for mosquito control during military operations. Large new demands have, of course, followed the extensive tropical activity of American forces. Public Health Service requirements in the United States will probably be about a half million pounds, mainly for malaria control in the Southern States. Perhaps 2 million lb. are wanted for hospitals, other institutional use, and for control of flying pests in such places as restaurants.

Civilian use as a household spray will probably be almost completely eliminated. But agriculture still has certain important requirements which they may get in part. "Essential" farm needs are of the order of 4 million lb., about one-third is for livestock sprays. Other requirements are for beans, cole crops, potatoes, tobacco, home gardens, and in small quantities for sugar beet seed crops, sweet corn, cranberries, and grapes.

ungicides, Disinfectants, Etc.

less otherwise indicated with name of material.)

Material	Supplies: Domestic Production	Supplies: Imports	Agricultural Requirements Estimated Domestic Consumption for Insecticidal, etc., Use: 1939	1942 (Oct. 1 to Sept. 30)	1943
Petroleum oils and distillates:					
Kerosene, gal. (1940)	3,103,044,000	8,568,000	12,000,000	12,000,000	.....
Mineral oils, gal. (1940) (statistics on lubricating oil).	1,544,130,000	462,000	12,000,000	12,000,000	
Phenols and nitrated Derivatives:			100,000	100,000	
Phenol (See footnote)	68,577,421	N.S.			
Dinitro-o-cresol (1940)	92,870 (sales)	N.S.			
Dinitro-o-cyclohexylphenol	confidential	N.S.			
Pine oil, gal	5,198,696	15,882	442,000	442,000	
Pine tar, gal	8,898,977	N.S.	50,000	50,000	
Pine tar oil, gal	1,153,359	N.S.	55,000	55,000	
Potassium permanganate (1940)	2,500,000	110	100,000	115,000	
Pyrethrum flowers (1940)	None	12,591,220	1,035,000	4,000,000	4,000,000
Rotenone-bearing roots			6,500,000	8,500,000	
Cube (1940) (Barbasco)	None	2,299,510	6,630,000 (1941)		4,705,000
Derris (1940)	None	3,220,972			
Timbo (1940)	None	1,046,333			
Sulphur and sulphur compounds:					
Lime-sulphur solution, gal	9,491,068	Raw materials are abundant in the U. S. Overall sulphur requirements for this purpose amount to 70,700,000 lb. This is but 1.6% of that available for domestic consumption in 1940.	9,491,068	10,000,000	
Sulphur dusts (including mixtures)	36,707,922			90,000,000	
Wettable sulphur	N.D.		3,000,000	4,000,000	
Organic thiocyanates:					
beta-Thiocyano-b'-butoxy diethyl ether, gal.			155,700	160,000	
Lauryl thiocyanate			14,760	19,000	
Tobacco insecticides (tobacco extract, also free nicotine and nicotine sulphate).	*3,170,000 (40% nicotine sulphate solution).	2,756	3,000,000	3,000,000 (calc. as nicotine sulphate soln. of 40% nicotine content).	3,197,000 to 5,243,000
Agricultural rodenticides:					
Glycerine (includes crude (80%), dynamite grade and chemically pure).	183,942,287	11,317,800	40,000	40,000	
Thallium sulphate (imported from France, Belgium and Germany) (1940).	3,000	Small amount	2,500	3,500	
Phosphorus (red)	N.D.	Production of metallic phosphorus amounts to nearly 100 million lb. per year.	100	100	
Red squill (powder) (Source of bulbs: Italy, Algeria and Lebanon).	None	Depended entirely on import of bulbs.	28,000	28,000 (min. toxicity 600 mg./kg.)	
Strychnine (1937) (Mfd. from nux vomica seed grown in Fr. Indo-China and British India, none in U. S.).	36,489	Depended on imports.	21,875	21,875	
Zinc phosphide	Not available	N.S.	2,500	2,500	
Wood preservatives:					
Copper arsenite	N.D.	N.S.	35,000	35,000	
Creosote oil, gal. (1940)	125,483,027	39,009,788	163,864,259	215,467,780 (1941) (inc. water gas tar solns.)	
Disodium hydrogen arsenate	N.D.	N.S.	266,000	266,000	
beta-Naphthol	confidential	N.S.	4,000	4,000	
Zinc chloride	28,821,165	649,881	1,951,517	1,403,863	
Chromated zinc chloride			2,570,553	4,382,511	

* (Can be increased 50-55% with present equipment)

Notations: N.S.—Bureau of Foreign and Domestic Commerce does not show imports or exports as a separate commodity. N.D.—No data could be located. Phenol: Present annual capacity (10/16/41) 130,421,000 pounds; stocks, Sept. 1, 1941, 1,522,000 pounds; includes by-product and synthetic. Miscellaneous chemicals, of importance but quantites required not known: Barium carbonate, Copper oxychloride, Copper silicate, Copper phosphate, Soap. Source of data, Governmental and Industrial Association's reports. Compiled by: Subcommittee on Insecticides, etc., M. A. McCall: Chairman, and Office of Agricultural Defense Relations, U. S. Department of Agriculture, Dec. 23, 1942.

ROTENONE

The raw material for rotenone production is the toxic principle contained in several root crops which now come principally from Peru and Brazil. Formerly, British Malaya and Netherland East Indies sources supplied about half our needs Principal imports of root materials are timbo, barbasco, cube, and derris roots. To stimulate production of these raw materials, trade agreements have been made with the major Latin American producers and recently Commodity Credit Corporation of the Department of Agriculture has become an exclusive purchaser of imports.

Estimated new supplies of roots (5 percent by weight of rotenone as a standard) with stocks now on hand may give as much as 3 million lb. for agricultural distribution this year. Increased supply cannot come quickly from Latin America as it takes two or three years' cultivation before harvesting. Competition for labor supply in the Amazon Valley is serious because of the new demands for rubber from that area. It is hoped that all current efforts will produce the 4 million lb. this calendar year which officials estimate as desirable for agricultural usage, but delivery is sure to be too late for use on this year's crops.

GENERAL SITUATION

In addition to these staple insecticides, large tonnages of other chemical poisons will be produced and used. This is fortunate because it would be calamitous to have any crop suffer partial or total destruction at a time when foods and fibers are so important in the war effort. A shortage in the supply of appropriate insecticides might well lead to serious consequences which could very much jeopardize next year's food program.

Among the chemical poisons which will be produced in large quantities to supplement those already mentioned are the diverse synthetic thiocyanates and various fluosilicates. The raw materials for the production of these chemical poisons are reasonably adequate, and the Food Production Administration of the Department of Agriculture is encouraging maximum output, not only of these components but also of any others which have proven merit.

Acid Pump Problems Involving Long Suction Lines

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Chem. & Met. INTERPRETATION

This is the third of a series of articles on installation and operation of acid pumps, the first two of which appeared in our January and February issues. The present article deals with the decrease in performance of a pump figured on the basis of water when handling a viscous liquid, such as cold, concentrated sulphuric acid, and shows by an actual example how such a pump may cease functioning entirely if the suction line resistance is too high. The next and last article will treat some new phases of packing and stuffing box troubles.—*Editors.*

PUMPING of high-viscosity oils through long pipe lines has required the development of considerable data on the performance of certain types of centrifugal pumps for handling viscous liquids, as well as the determination of friction losses in pipe lines carrying such liquids. Manufacturers of pipe line pumps know the relative performance of these pumps on oils of various viscosities. Graphical data which are very complete are available for calculating pipe friction losses, so that an installation for pumping viscous oils is usually just as carefully engineered as a common water pumping job, and the results can be predicted just as accurately.

Relatively little is known, however, about the performance of most "chemical pumps" when they are used for pumping heavy, viscous liquids, such as cold, concentrated sulphuric acid and cold, commercial caustic soda solutions. Furthermore, data on the viscosity of such liquids are usually not readily available to the average plant engineer who lays out the piping system and selects the pumps for handling these and other viscous and more or less corrosive solutions. This condition is the one principally responsible for certain misapplications and faulty installations. However, some false conceptions of the hydraulics involved have been to blame for a number of installations that could not possibly have functioned with heavy, viscous solutions, although the same system would have been suitable for the handling of low-viscosity liquids similar to water.

The purpose of this article is to show why an installation that will work satisfactorily on water may not be suitable when a heavy, viscous liquid is involved. Also it shows the mechanics of the calculations required to select piping and a pump that will insure satisfactory performance. It is only the occasional installation that proves so faulty that it does not "get by." The reason for this may be the large factor of safety or "factor of ignorance" used in the calculations, or it may be that a slower pumping job than the specifications requested is still fast enough. In these days of material shortages, an installation should not be figured with a wasteful factor of safety. At the same time production must not suffer because the pump and piping system is incapable of sufficient capacity.

Fairly common problems in chemical plants, and in plants using chemicals, are the transfer of such materials from tank cars to storage tanks, from storage tanks to tank cars and barges, and from storage tanks to the point of use in the plant. Caustic soda tank cars and storage tanks are usually equipped with steam heating coils and thus, if the pump and the system are figured with too little capacity for a given caustic soda temperature, it is a simple matter to reduce the friction losses in the system by increasing the liquid temperature and thus reducing its viscosity.

Sulphuric acid, on the other hand, can not be heated in the same manner as caustic soda solutions on account of corrosion problems and the accompanying hazards. The commercial grades of concentrated sulphuric acid are heavy and quite viscous at low temperatures. At some concentrations the problem of freezing is also present. Sulphuric acid manufacturers frequently make several grades or concentrations of acid, and some sulphuric acid consumers use large quantities, at different concentrations, requiring several storage tanks of large size. Where such storage tanks are grouped in one location and served by a single acid pump, the suction manifold piping may be quite long with many fittings and valves to introduce friction losses into the system. It is not unusual for the total system head (total dynamic head, TDH) to allow the pump to handle so much acid that the friction losses on the suction side of the pump become too high. Then cavitation results, with all its evil effects. Under such conditions the capacity of the pump falls off and frequently fails entirely owing to air inleakage into the system or into the pump through the stuffing box. Hence, the net positive suction head (NPSH) required must be known definitely when selecting an acid pump for such a system.

The problem of figuring the most economical piping system and method of operating an acid pump on such a system has been covered in an earlier article (*Chem. & Met.*, Jan. 1943, page 86) in a discussion of tank car loading pumps. In this earlier article it was assumed that the suction conditions were satisfactory for the pump being used. This present article uses a similar general layout as an example, but with a suction line loss that is too high for the system when handling cold 98 percent sulphuric acid.

To illustrate this point we assume

Table I—Friction Losses and Total Dynamic Head for Water and Acid in System of Fig. 1

Flow Rate, G P.M.	Friction Losses per 100 Ft. of 2-In. Pipe, Ft.		Total Friction Losses in System, Ft.		Total Dynamic Head, Ft. — Full Tank		Total Dynamic Head, Ft. — Empty Tank	
	Water	Acid	Water	Acid	Water	Acid	Water	Acid
40	6.6	15	14.2	32.2	24.2	42.2	33.2	51.2
50	9.9	22	21.3	47.3	31.3	57.3	40.3	66.3
60	14.0	30	30.1	64.5	40.1	74.5	49.1	83.5
70	18.4	40	39.6	86.0	49.6	96.0	58.6	105.0
80	23.5	54	50.6	116.0	60.6	126.0	69.6	135.0

an acid pump has been selected to deliver 75 g.p.m. of 98 percent H_2SO_4 in a location where the elevation corresponds to a barometer of 26 in. Hg. The diagrammatic layout is shown in Fig. 1. We also assume that calculations for selecting the pump and the piping were made on the basis of the friction tables for water in 15-year-old smooth iron pipe (Williams and Hazen Friction Tables for Water). This method is used with surprising frequency for figuring an acid pumping job, either because complete data are not at hand, or because of the failure to appreciate the method's potentialities for operating troubles. Sometimes a "factor of safety" is used by selecting an oversize pump. However, in a system with too high friction losses on the suction side of the pump, this makes the situation even worse.

In what follows the figures are derived from calculations based on water friction, and the pump is selected on the basis of performance on water (the usual method of rating acid pumps). To arrive at equivalent figures for acid it is necessary to calculate, first, the greater friction loss in the pipe line due to the higher specific gravity and greater viscosity of the acid and, second, the derated performance (if any) of the centrifugal pump when handling a solution more viscous than water.

Easily used data for figuring pipe friction for any liquid have been presented by Chilton and Genereaux and were referred to in the first article of this series (*Chem. & Met.*, Jan. 1943, page 88). These authors presented an alignment chart (*Ind. Eng. Chem.*, **22**, p. 1384, 1930) for viscosities of various liquids at varying temperatures. A similar but more extensive list is to be found on pages 794 and 795 of Perry's Chemical Engineers' Handbook (2d ed.). They also presented a nomograph (*Chem. & Met.*, **37**, p. 689, 1930, a small reproduction of which appeared in the first article of this series) whereby it is possible to calculate the pressure drop of any liquid flowing in a pipe line, provided its kinematic viscosity is known, if the pressure drop of water flowing at the same rate in the same line is known. [Mr. Pratt will gladly supply reprints of the first and last mentioned charts to interested engineers.—Editor.]

Fig. 1—The long suction line of this acid pumping system gives rise to special problems in handling viscous liquids, which are discussed in this article

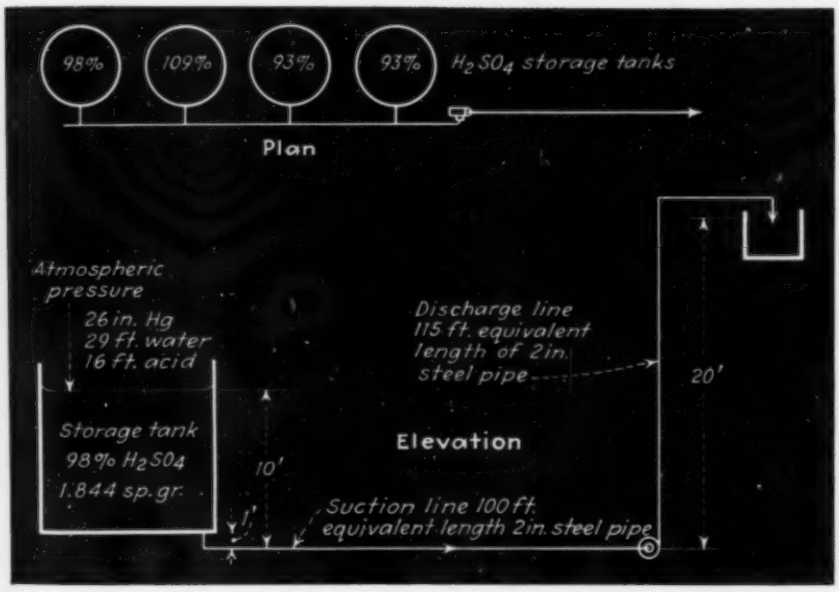
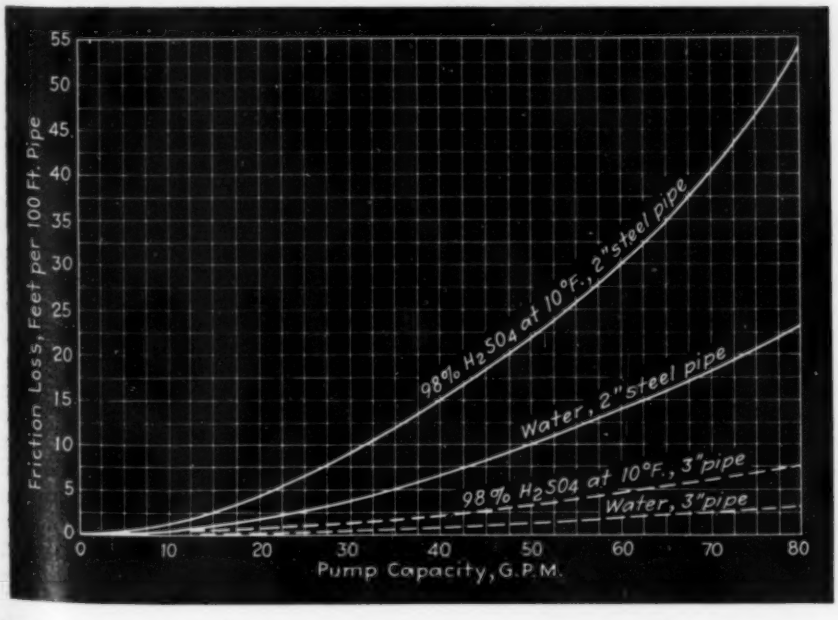


Fig. 2—Friction losses with water and 98 percent sulphuric acid in steel pipe



Assuming a 10-deg. F. minimum temperature for the acid and referring to one of the viscosity charts mentioned above, it is found that 98 percent H_2SO_4 has an absolute viscosity of 75 centipoises, or a kinematic viscosity of 75/115 = 0.652, where kinematic viscosity = centipoises ÷ specific weight in lb. per cu.ft. In terms of specific gravity this is 75/1.84 = 40.7 centistokes, which by conversion with available tables in handbooks is found to equal 188 Saybolt Seconds Universal (S.S.U.) This last method of expressing viscosity is valuable, since most pump manufacturers rate their pumps for viscosity in terms of S.S.U.

By use of the third mentioned chart (see also *Chem. & Met.*, Jan. 1943, p. 87) the friction losses for the piping system when handling acid can be determined when the losses with water are known. In Table I are listed the losses with water, determined from the Williams and Hazen Tables. In parallel columns are shown the losses with acid, determined from the Chilton and Genereaux chart. From these data the variations in friction losses for water and for acid can be plotted in Fig. 2.

In this discussion, as noted, it is assumed that a pump has been selected on the basis of handling water. The "rated" performance curve for the pump when handling water is shown as the upper "head-capacity" curve in Fig. 3. On the same chart are shown the friction system curves for the installation, obtained by using the data under "Total Dynamic Head" from Table I. Where the friction system curves cross the pump head-capacity curve, we can read the actual performance of the pump. This shows an average capacity of 75 g.p.m., indicating a correct selection for water.

It is now necessary to establish the probable performance of the pump when handling 98 percent H_2SO_4 at 10 deg. F. The pump manufacturer may

Table II—Intersections of Head-Capacity and Friction System Curves of Fig. 3 for Water and Acid, 2-In Pipe

	—Empty Tank—		—Half-Full— Tank		—Full Tank—	
Liquid	G.P.M.	B.Hp.	G.P.M.	B.Hp.	G.P.M.	B.Hp.
Water.....	71	1.85	75	1.90	78	1.95
Acid.....	46	3.75	49	3.80	52	3.90

be able to supply this information, but if it cannot be secured as soon as required, a close approximation of the probable performance of a typical end-suction, closed-impeller pump can be calculated from the curves shown in Fig. 4. Derating the acid pump on the basis of the typical performance curves in Fig. 4, based on maximum efficiency, we get the following approximate percentages of the pump's performance when it is handling water:

Capacity = 94 percent of that for water
Head = 95 percent of that for water
Efficiency = 75 percent of that for water

By using these correction factors (at maximum efficiency) we can draw in on Fig. 3 a close approximation of the head-capacity performance curve for the pump when handling the cold acid. The brake horsepower curve for the pump when handling acid can be plotted from the formula

$$\text{B. Hp} = \frac{\text{G.P.M.} \times \text{TDH} \times \text{Sp. Gr.}}{3{,}960 \times \text{Efficiency}} \qquad (1)$$

Now, by plotting in the friction system curves established for the acid, as tabulated in Table I under "Total Dynamic Head," we can establish the actual capacity of the cold acid that the pump will handle, *provided the suction conditions are such as to allow the pump to function in its normal manner.* Table II tabulates the data read from the intersection points of the head-capacity pump performance curves and the friction system curves for water and cold acid in 2-in. steel pipe.

These data show that the pump selected for 75 g.p.m. on the basis of water will not deliver anywhere near this volume of cold acid. They do not as yet show whether the suction conditions will even permit the pump to handle this much acid without trouble. Therefore, our next step will be to investigate the suction conditions existing when the pump is delivering—or trying to deliver—the amount of acid permissible in accordance with the total dynamic head as calculated (Table II).

By referring to the friction loss curves (Fig. 2) and by using the theoretical capacities from Table II, we can now tabulate in Table III the friction losses in the suction line *only* (100 ft. equivalent length of 2-in. steel pipe) and calculate the absolute pressure at the pump inlet. The absolute pressure at the pump inlet equals atmospheric pressure expressed as feet

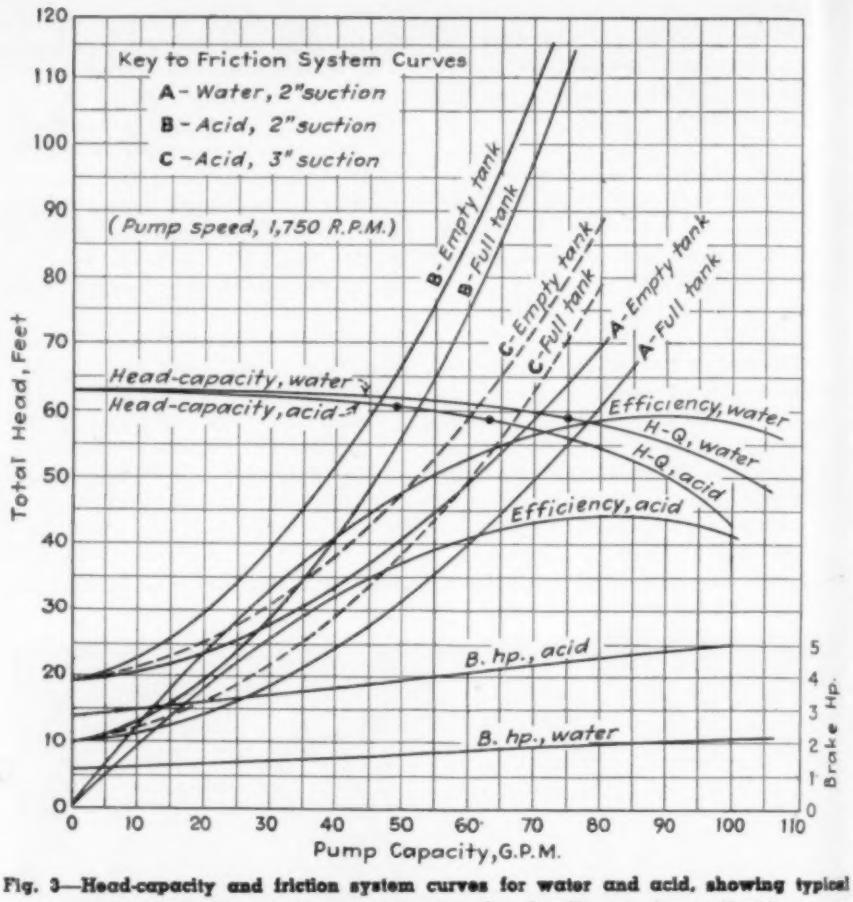


Fig. 3—Head-capacity and friction system curves for water and acid, showing typical capacity decrease and power increase when handling a viscous liquid

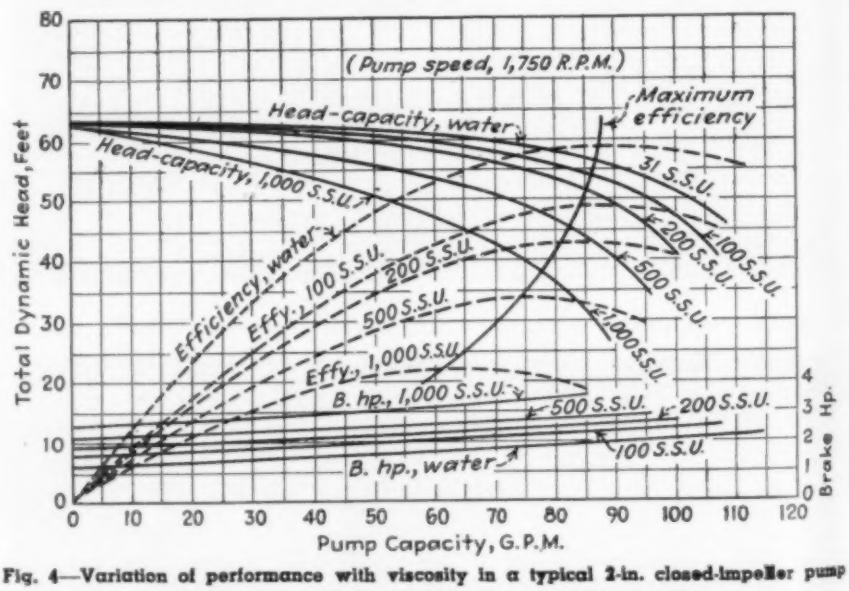


Fig. 4—Variation of performance with viscosity in a typical 2-in. closed-impeller pump of the type used for handling strong sulphuric acid

of the liquid pumped, plus the static suction head, minus the pipe line friction, and minus the vapor pressure of the liquid at the existing temperature.

From these data we arrive at the theoretical absolute pressure at the pump inlet, provided that the indicated rate of flow actually existed. This is usually called the "net positive suction head" (NPSH) *available*. Every centrifugal pump requires some "head" or absolute pressure at the pump inlet to push the liquid far enough into the impeller so centrifugal force can become effective on the liquid. If enough pressure is not available to do this the liquid will flash into vapor in the eye of the impeller and the pump will cavitate. This will result in intermittent flow creating noise and a loss of capacity. When a pump cavitates, in most designs it is probable that there

is a high vacuum on the stuffing box or boxes. If much air leaks into the pump at this point the pump will cease pumping entirely.

The higher the rate of theoretical flow through the system, the more friction and velocity head loss occurs from the pump inlet nozzle, through the eye of the impeller, into the impeller vanes. The theoretical amount of this loss, at any given capacity, can be calculated if all dimensions are known, but the exact amount is usually determined by tests and can be shown by an additional curve on the pump performance chart. This unavoidable loss is known as the "net positive suction head" *required*. Pumps designed especially for handling hot liquids, or liquids of high vapor pressure, such as boiler-feed or gasoline pumps, have lower NPSH characteristics than pumps designed for pumping cold water. Acid pumps usually have fairly liberal dimensions at the impeller eye, as it is quite usual for chemical pumps to be used in handling hot liquids. The hotter the liquid, the higher the vapor pressure and this vapor pressure must be deducted from the atmospheric pressure in calculating the absolute pressure at the pump inlet. In our example problem, the vapor pressure of the cold acid is so low that it has been disregarded.

A typical end-suction, closed-impeller acid pump operating at the capacities being considered in our problem would require 5 to 10 ft. NPSH in a pump of 1½-in. size (2-in. suction); and 2 to 5 ft. NPSH in a pump of 2-in. size (i.e., with 3-in. suction). The pump selected in our problem, suitable for delivering 75 g.p.m. of water, and having the performance characteristics at 1,750 r.p.m. shown in Fig. 3, has a 2-in. discharge nozzle and 3-in. suction nozzle. As stated above, such a pump could be assumed to require less than 5 ft. NPSH. Actually the manufacturer's tests show 4.7 ft. NPSH required at 78 g.p.m. and only 3.0 ft. NPSH at 52 g.p.m. (see Table III, last column), which is the maximum capacity of acid it could handle. It is therefore apparent from the data in the last two columns of Table III that the pump selected, while quite suitable for pumping water through the assumed system, is not at all suitable for pumping the cold 98 percent sulphuric acid.

The obvious move to correct this situation is to install a larger suction line to reduce the high friction loss.

If a 3-in. suction line is considered, we can then calculate the friction losses in the suction line and the 2-in. discharge line, thus establishing the TDH at various capacities. For convenience the friction losses in 3-in. steel pipe for both water and the acid have been shown graphically on Fig. 2. Data for establishing the friction system curves with a 3-in. suction line are calculated in the same manner as for Table I, and these data are listed in Table IV. From these data the friction system curves can be inserted on the pump performance graph, as shown by the dotted lines of Fig. 3. Since we can now read as before the theoretical capacity of acid that the pump will deliver with a 3-in. suction line, we can again calculate the friction loss in the larger suction line and thus arrive at the absolute pressure at the pump inlet, or in other words, the new NPSH *available*. These data are tabulated in Table V.

From these figures which show ample available pressure at the pump inlet over that required by the pump, it is obvious that the pump will handle without trouble even colder and more viscous acid than that specified. However, the maximum capacity of 66 g.p.m. with a full storage tank is less than the 75 g.p.m. originally specified. Since the extreme cold conditions seldom exist, and since the pump will handle more acid at higher temperatures on account of lower viscosity, it is possible that the pump selected will be satisfactory. If 75 g.p.m. is the absolute minimum capacity permissible, either a larger discharge line (such as 2½-in.) will be required, or a pump with larger diameter impeller must be used, which will require more power. If a 2½-in. discharge line is considered, the same procedure must be followed as outlined above to establish the actual capacity that can be pumped at possible extreme temperature conditions, so that a motor can be selected which will operate at an efficient point. The suction condition also must be re-checked, since with the larger discharge line more acid will be handled and the friction loss in the suction line will increase.

It is interesting to note a possible error in figuring brake horsepower when an acid pump is selected on the basis of water performance. It may be thought that the correct brake horsepower is that for water multiplied by the specific gravity of the acid. In our example problem, it would be calculated as $1.9 \times 1.844 = 3.5$. The actual brake horsepower with a 3-in. suction line and a delivery of 66 g.p.m. is 4.2 as read from the brake horsepower curve of Fig. 3, and as calculated by Equation (1). This is 20 percent higher, even though less acid is handled than was originally intended. In some cases a 20 percent increase in power over that calculated would result in motor trouble.

This practical example shows how important it may be to check the actual conditions at the pump inlet when a heavy, viscous liquid is to be handled and when the suction conditions may cause considerable drop in pressure between supply and pump.

Table III—Inlet Conditions of Pump for Theoretical Flow When Handling Water or Acid With 2-In Suction Line

Storage Tank Level	Liquid Pumped	Theoretical Cap., G.P.M. (Table II)	Atm. Press., Ft. of Liquid[1]	Static Suction Head, Ft.	Suction Line Friction Loss, Ft.	NPSH[2] (Avail.), Ft.	NPSH[3] (Req.), Ft.
Full	Water	78	29.5	10	22.3	17.2	4.7
	Acid	52	16.0	10	23.5	2.5	3.0
Half full	Water	75	29.5	5	20.7	13.8	4.5
	Acid	49	16.0	5	21.2	− 0.2[4]	2.9
Empty	Water	71	29.5	1	18.8	11.7	4.2
	Acid	46	16.0	1	19.2	− 2.2[4]	2.8

[1] At 26-in. barometer. [2] Abs. pressure at pump inlet equals col. (4) + col. (5) − col. (6). [3] Characteristic of individual pump, supplied by pump manufacturer. [4] Impossible pressure indicating liquid in suction line would "break."

Table IV—Friction Losses and Total Dynamic Head for Acid Pump With Enlarged Suction Line

Flow Rate, G.P.M.	Friction Losses, Ft. 3-In. Suction Line	Friction Losses, Ft. 2-In. Discharge Line	Total Friction Losses, Ft.	Total Dynamic Head, Ft. Full Tank	Total Dynamic Head, Ft. Empty Tank
40	2.3	17.2	19.5	29.5	38.5
50	3.7	25.3	29.0	39.0	48.0
60	5.0	34.5	39.5	49.5	58.5
70	6.5	46.0	52.5	62.5	71.5
80	8.1	62.0	70.1	80.1	89.1

Table V—Inlet Conditions of Pump for Theoretical Flow When Handling Acid With 3-In Suction Line

Storage Tank Level	Liquid Pumped	Theoretical Cap., G.P.M. (Fig. 3)	Atm. Press., Ft. of Liquid[1]	Static Suction Head, Ft.	Suction Line Friction Loss, Ft.	NPSH[2] (Avail.), Ft.	NPSH[3] (Req.), Ft.
Full	Acid	66	16	10	5.8	20.2	3.9
Half full	Acid	63	16	5	5.3	15.7	3.7
Empty	Acid	60	16	1	5.0	12.0	3.5

[1] At 26-in. barometer. [2] Col. (4) + col. (5)—col. (6). [3] From pump manufacturer.

Batch-Continuous Process for Buna-S

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Chem. & Met. INTERPRETATION

The authors have developed an arrangement of equipment for producing the butadiene-styrene type of synthetic rubber latex by either a batch or a continuous process, employing the same equipment, but with a different setting of the valves. Such a hook-up enables the user to employ either type of operation at will, also permitting batch starting and shutting-down when the continuous process is used. The equipment layout is based on a rigorous mathematical approach to the problem of continuous reacting and introduces new features in the recovery of uncombined reactants to assure efficient and trouble-free operation.—*Editors.*

SO FAR, in the United States, sufficiently extensive experience with the butadiene types of synthetic rubbers has not been accumulated to permit the standardization of optimum processing procedures and arrangements of equipment, nor to indicate the best possible design of the individual items of equipment. The urgent demands of the war effort makes a gradual and highly organized investigation almost impossible, but fortunately there is a background of experience in other industries which should be of material assistance. For example, numerous comparable problems have been solved in the synthetic resin industry. If precise analogies from synthetic resin chemistry are not available, still various unit aspects are decidedly similar.

For example, synthetic resins are also polymers and some of them, such as the vinylite resins, are also co-polymers, as are the Buna-type rubbers. Like rubber synthesis, many resins require controlled reaction temperatures and the removal of heat of polymerization during the reaction. Production of the coumarone-indene resins is similar in that polymerization occurs in a heterogeneous reaction system, while that of the phenol-formaldehyde and urea-formaldehyde resins is similar in that the reaction product exists as the discontinuous phase in an emulsion system.

Resin equipment experience is also directly applicable in the design of many of the elements of Buna plant equipment. For example, analogy gives valuable information on the optimum size of autoclaves, the kind and intensity of agitation, and on the details of agitators, stuffing boxes, shaft guides and other appurtenances.

At the present time most of the development work on Buna type rubbers in the United States has been carried out by batch methods of operation. However, it can be shown that in addition to various economies in heat and electrical consumption which are inherent in continuous operation, the latter method also makes possible an increase in capacity with the same volume of tankage as great as 40 percent in certain plant sizes. The design of plant described here has been arranged to permit either batch or continuous operation. The same equipment is employed in either case, but the grouping of the equipment is altered by the setting of the valves, depending on whether batch or continuous operation is chosen. Therefore, the arrangement is such that a shift to continuous production can readily be made. Furthermore, the hook-up allows the equipment to be started batchwise, run continuously, and then shut down under batch operation when operation is to be discontinued, to prevent loss of valuable materials.

The accompanying flowsheet, Fig. 1, is a somewhat simplified version of that for a plant having a batch capacity of 7,500 long tons per year and a capacity under continuous operation of about 10,500 long tons per year. The composition of the reaction mixture by volume is assumed to be: 31.3 percent butadiene; 10.42 percent styrene; 10.42 percent soap solution; 0.86 percent chain directive agent (catalyst); and 47 percent treated water. The polymerization reaction cycle is taken as 23 hours on the batch basis, with the assumption of 91 percent completion of the reaction based on the starting quantities of butadiene and styrene. The operating conditions discussed below are not necessarily optimum but are given merely to illustrate the proposed method of operation.

STORAGE CAPACITY

The precise storage tank volume needed for butadiene, styrene and the catalyst varies with the ease with which replenishments of supply for the plant can be scheduled. When continuous apparatus is employed for supplying treated water and soap solution, the reserve capacity for these materials should be based on requirements during the probable outage time for repairs.

Plants for Buna-S production must take precautions to prevent the spontaneous polymerization of both butadiene and styrene under moderate storage temperatures. They must also insure against the building up of appreciable concentrations of butadiene peroxide in the atmosphere immediately surrounding the plant, or either the sudden or progressive building up of this material within the equipment system. An appreciable concentration of butadiene peroxide entails an explosion hazard of appreciable magnitude.

Prevention of spontaneous polymerization is accomplished by the addition of various anti-polymerization inhibitors which are dissolved in the butadiene and styrene in storage and are later removed before the reaction, as is described in another section. Another means employed to avoid premature polymerization is to maintain the storage temperatures of these materials at constant optimum values, depending on the characteristics of the inhibitors employed. A suitable type of cooling surface for this purpose is a removable U-tube bundle inserted in the storage vessel in which any type of coolant consistent with the cooling requirements can be applied. Since polymerization cannot be completely prevented, there will therefore be some progressive building-up of polymer films on the heat transfer surfaces. Their overall coefficients of heat transfer must, therefore, be taken quite conservatively to guard against frequent cleaning of the tube surfaces. It is desirable to employ non-copper-bearing alloy tubes, preferably having a high external finish to inhibit the formation of a corrosion

film. A corrosion film would not only reduce heat transfer, but also would offer a better surface for the adhesion of polymerization products.

The leakage of significant amounts of butadiene at any point in the system would result in the hazard of butadiene peroxide accumulation. This can be avoided by piping all points where considerable leakage could take place, such as from relief valves, to a concentrated sulphuric acid trap. The reaction of butadiene with concentrated H_2SO_4 yields a variety of polymer products of nondescript character which do not constitute explosion hazards.

Venting to the sulphuric acid scrubber thus prevents build-up of butadiene peroxide in the environment of the plant. To prevent its formation in the reaction system, the use of an inert gas can be made effective. Each of the formulation components except the butadiene exerts a negligible vapor pressure at storage temperatures and hence there is a marked tendency for air to enter the vessels, to be dissolved in the material or mechanically entrapped. Hence all storage vessels except that for butadiene are maintained under an atmosphere of inert gas.

Normal carbon steel plate is used for the fabrication of the butadiene and styrene storage vessels, while glass-lined vessels are preferably used for the catalyst, soap solution and water storage tanks. The butadiene storage vessels are built for a considerably higher working pressure than the vapor pressure exerted by butadiene at the storage temperature, to take into account the possibility that the tanks may be subject to high atmospheric temperature during a failure or shut-down of the cooling system. Design pressures as high as 100 lb. per sq.in. gage have been used for butadiene, the vessels being equipped with safety devices common to the design of pressure vessels. For economy in plant space the butadiene and styrene storage tanks can be placed outdoors, with the other storage vessels indoors.

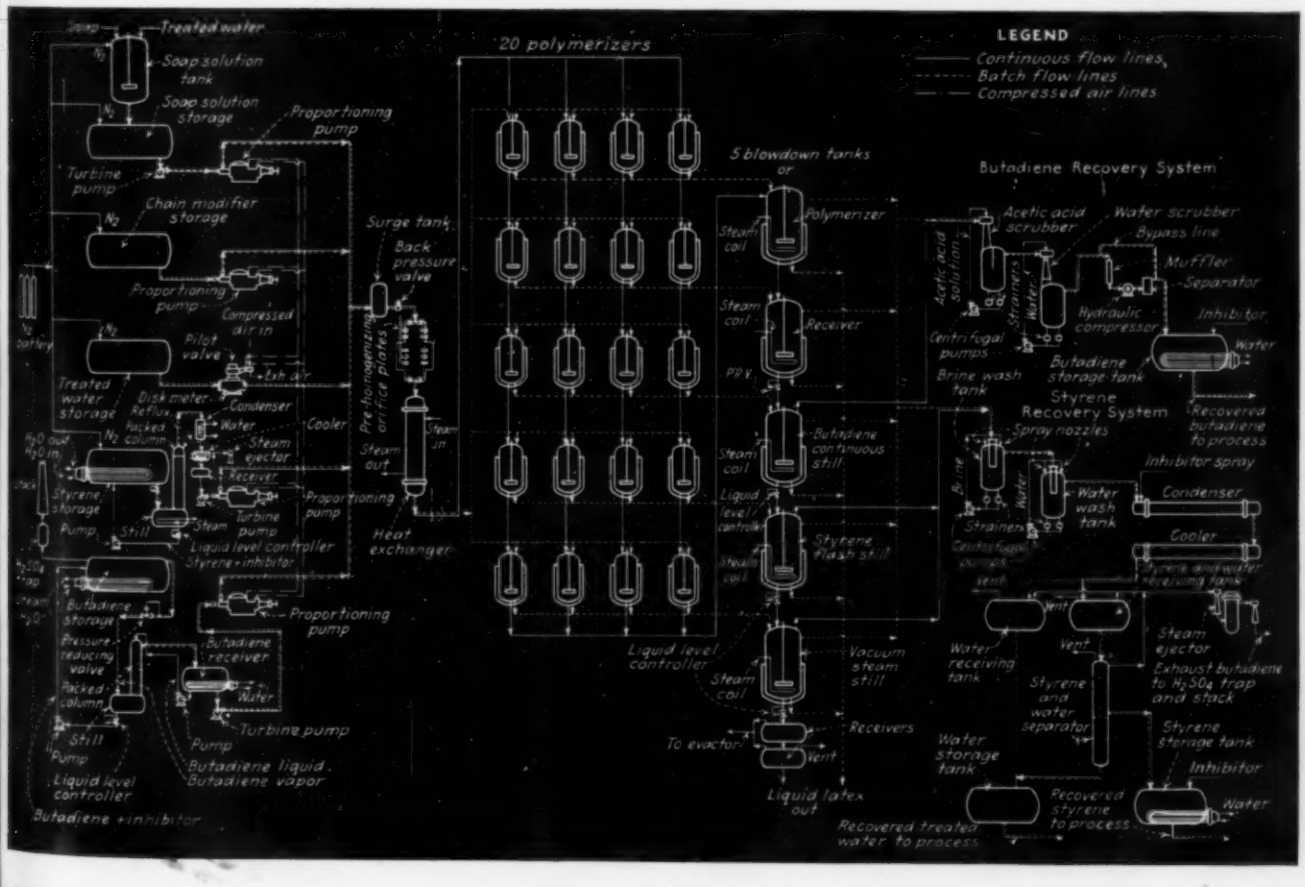
FEED SYSTEM

Whether the batch or continuous polymerization reaction is employed, the same types of equipment can be used. The first problem is to separate the inhibiting agents from the styrene and butadiene as they are drawn from storage. The specific means employed will vary, of course, with the properties of the inhibitors used but they can, in general, be separated as described below.

A wide variety of materials has been used for the inhibiting of both butadiene and styrene. Generally, these are organic solids which are directly soluble in liquid butadiene and styrene and have very low vapor pressures at the storage temperature. In either case, it is possible to distill the butadiene or styrene away from the inhibitor, returning the latter to the storage vessel for continuous re-use.

The distillation equipment for butadiene consists of a still at the bottom of a Raschig-ring-packed tower, connected by a line containing a constant back-pressure valve to the vapor space of the butadiene storage tank. The U-tube bundle in the storage tank is connected to sources of both low-pressure steam and a coolant, with a thermostatic control for maintaining the temperature of the storage vessel constant at some optimum storage temperature, generally about 50 deg. F. Vapor from the storage tank is led into the still and up through the packed column where it is washed with pure butadiene liquid reflux, returned by means of a pump from the butadiene receiver. The receiver is maintained at a lower temperature, such as 35 deg. F., to maintain a vapor pressure differential from the storage tank to the receiver (6.25 lb. per sq.in. in this case). Since a pure liquid will exert a constant vapor pressure at a constant temperature, the vapors issuing to the receiver are condensed. Butadiene is thus boiled from the storage vessel

Fig. 1—Simplified flowsheet of batch-continuous plant for reaction of butadiene and styrene to Buna-S latex



at 50 deg. F. and condensed in the receiver at 35 deg. F. The packed tower effects both a thermal separation of butadiene vapors from the inhibitor vapors, and a mechanical separation of entrained inhibitor. The inhibitor, dissolved in the butadiene reflux, is pumped back to the butadiene tank.

The distillation equipment, which is designed for batch operation on the basis of a 30-minute charging cycle, carries a much larger load under batch operation than during continuous operation. For batch operation approximately 81 g.p.m. of butadiene would be required and, with a 5 to 1 reflux ratio, this would amount to 2,080 cu.ft. per min. of vapors at the 50 deg. F. storage temperature. Condensation of the required butadiene in the receiver, with a latent heat of 168 B.t.u. per lb. of butadiene, would require approximately 5,500,000 B.t.u. per hr. of cooling capacity.

A somewhat similar system, which, however, must operate under vacuum, can be employed for the separation of soluble organic inhibitors from styrene, when these are of the negligibly low vapor pressure type. Since styrene polymerizes at moderate temperatures, it is desirable to conduct the distillation under high vacuum. Liquid styrene is conducted through a liquid-level operated valve (made responsive to a pre-set liquid level in the receiver) to a still equipped with a steam-heating coil and topped with a packed column which serves the same purpose as the butadiene column. The steam coil provides the heat necessary to vaporize the styrene feed. The vapors from the tower are condensed, part being refluxed as in the case of butadiene recovery, and part being cooled somewhat farther in a cooler to avoid the possibility of flashing of the condensed styrene from the styrene receiver owing to momentary upward fluctuations of the vacuum. A subcooling of the condensate of about 10 deg. F. should be adequate when a steam jet ejector is used for vacuum production. Under ideal conditions the distillation of the styrene should be carried out under a maximum temperature of 90 deg. F. and a vacuum of 29.2 in. Hg. By setting the receiver at an elevation of 36.7 ft. above the turbine pump used to feed the proportioning pump, the vacuum head on the pump can be overcome. Systems differing only in the details of construction of the still column may be used to separate other types of inhibitors from styrene.

Several types of proportioning equipment can be used for the simultaneous feeding and proportioning of the inhibitor-free butadiene and styrene, the soap solution, chain modifier and treated water. The type indicated in the flowsheet is that made by Proportioneers, Inc., with the treated water flow serving as the metered component. In the set-up illustrated, the several proportioning pumps are motivated by compressed air under the influence of a pilot valve mechanism, attached to the treated water meter. By adjusting the rate of treated water feed, the rate of feed of all other ingredients is automatically adjusted.

Since only the catalyst proportioner is capable of drawing its own feed and building the pressure up to that required for discharge, the styrene, butadiene and soap solution proportioning units are provided with turbine type pumps preceding the proportioning pump. To provide for adjustment of the various feed rates, the turbine pumps are equipped with bypasses from the discharge back to the suction. The metered discharge from each proportioning unit is sent to a common header and thence to a surge tank. The surge tank is provided primarily to bring the butadiene vapor into equilibrium with the liquid phase and so to prevent gas binding of the lines or the butadiene pump or meter. It has a further effect of producing a partial homogenization of the proportioned stream, especially in the check valve at its exit. This latter valve is provided to prevent butadiene from flashing back through the system in the event of feed stoppage.

PRE-HOMOGENIZING

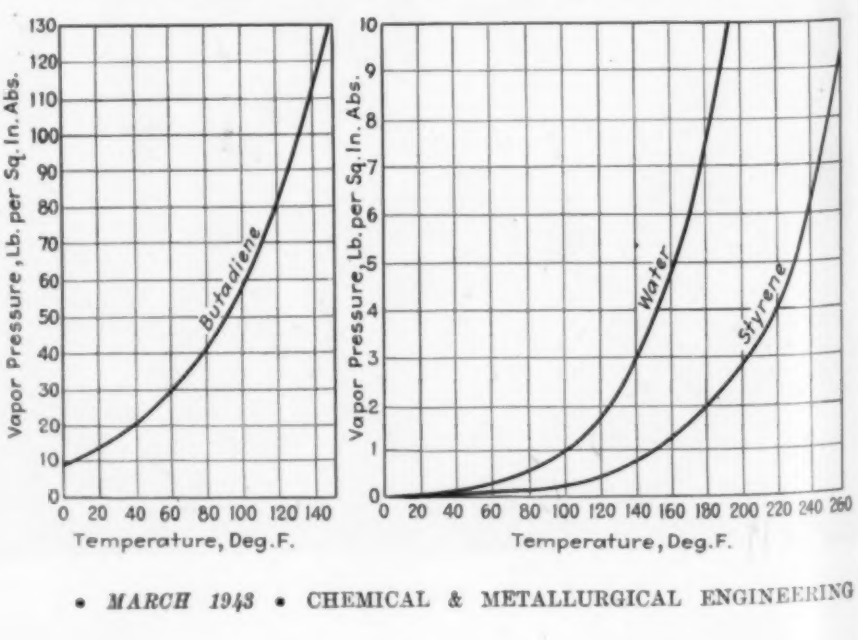
Owing to the heterogeneous nature of the reaction mixture, it is necessary to pre-homogenize the proportioned stream leaving the feeding system if uniformity of the formulation is to be assured. This is all the more necessary owing to the fact that the proportioning pumps deliver material in "slugs." An orifice plate manifold is suitable for pre-homogenization.

Any heterogeneous system can come to a desired degree of dispersion only by putting external work into the system. The work required to attain the desired degree of emulsification in the mixture used for the reaction under discussion can be determined rather easily in a small batch mixer and from this the necessary pressure drop across a suitable orifice manifold can be calculated. The total discharge area needed can be distributed among a suitable number of orifice plates, but it must be understood that the actual pressure drop across such a manifold may well exceed the arithmetic sum of the theoretical drops for each orifice, especially where turbulent flow obtains. As shown in the flowsheet, in order to accommodate both batch and continuous operations, it is necessary to arrange to bypass a number of the orifice plates when the smaller feed rate of the continuous process is used. Furthermore, owing to the possibility of progressive accumulation of polymer in the orifices during homogenization, an auxiliary duplicate manifold must be provided for use while cleaning of the first manifold is being carried out.

The orifice type of pre-homogenizer has the advantage of being a continuous unit which is low in initial cost, yet has no disadvantages from the standpoint of efficiency. It should be noted that if the mean temperature of the homogenizer stream would impair the solubility of the soap in the mixture, the pre-homogenizer should follow the heat exchanger which precedes the reaction section.

To permit the maximum possible

Fig. 2—Vapor pressures of butadiene, styrene and water



reaction time in the polymerization vessels, a tubular heater is provided in the line from the pre-homogenizer to the reactor vessels proper. This heater relieves the latter of the burden of raising the material temperature to that required for reaction. Taking the temperatures of the butadiene and styrene as those established by the condensation equipment previously described, and the temperatures of other materials as 55 deg. F. minimum, the blend temperature of the feed entering the heater will be approximately 54 deg. F. To increase the temperature of the mixture to the reaction temperature of 113 deg. F., under the conditions of batch operation, will require a heater having a service rating of 5,500,000 B.t.u. per hr. for a 30-min. charging cycle. With 100-lb. steam and a conservative heat transfer coefficient, an 827 sq.ft. heater of the single pass, floating-head type will be adequate. To facilitate cleaning, the reaction mixture is handled on the tube side. Tubes and bonnets are of Type 304 stainless steel. A heater designed for batch operation will be much more than adequate for the lower hourly load rate imposed by continuous operation. To provide for automatic shifting of the heat exchanger from or to batch operation, the rate of the steam feed to the shell side is made responsive to the temperature of the effluent emulsion. This is done by using a standard flow controller of the throttling type.

REACTION SECTION

For batch operation of a plant of 7,500 long tons per year polymer-producing capacity, a battery of 20 agitated, jacketed autoclaves having a working capacity of 1,550 gal. each is adequate. In batch operation, five vessels are charged simultaneously every six hours. Thus 20 batches of latex are discharged every 24 hours. The operation cycle includes a 23-hour reaction period, with one-half hour each allowed for charging and discharging of the reactors.

For continuous operation the 20 reactors are connected by an alternative piping arrangement into four tandems of five vessels each.

The considerations determining the size of the autoclaves comprising the reaction section are: (1) the batch capacity required of the plant; and (2) the heat exchange surface requirements of the reaction. The arrangement of the autoclaves for continuous throughput involves the reconciling of three basic factors: (1) accomplishing a certain maximum completion of reaction of the effluent; (2) restricting the mean square deviation from the mean holding time in the reactor equipment within desirable limits; and (3) achieving a maximum throughput capacity.

Without going into too much detail regarding the principles of continuous reactor design, we may state concerning these factors that: (1) proper determination of the rate of throughput through either one or a series of vessels makes it entirely possible to attain any desired completion of reaction; and (2) the mean square deviation from the mean holding time which is thus established for the various portions of the effluent, however, need not be optimum for the reaction at hand. A major consideration where polymer chemistry and certain instances of organic synthesis are concerned is the possibility that any given arrangement of vessels may permit a holding time for some portions of the throughput which would allow side reactions or the building up of polymers of undesirable chain length. (A treatise by the authors and E. Z. Barish, reducing to practical application the mathematical investigations into continuous reactor design developed by the senior author of this paper, is in preparation for early publication. The forthcoming paper will set forth the background and reasons for the greater efficiencies obtainable with continuous as compared with batch operation.—*Editor.*)

The reactors proper are similar in design to typical resin autoclaves, such as those described in the authors' previous paper on resin plant design (*Chem. & Met.*, Dec. 1941, p. 73). Agitation is provided by turbine or propeller mixer units. Stuffing boxes are of the hydraulically balanced, double-lantern-ring type to provide especially efficient sealing against butadiene leakage. In a unit of this size approximately 7 hp. is required for agitation, exclusive of frictional dissipation of power in the drive and stuffing box assembly. This rate of work input is necessary, first to provide the required conditions of forced convection on the batch side of the heat transfer surface; and second, to re-establish the emulsion continuously against its tendency to break under constantly changing conditions of chemical composition during the reaction period.

Stainless or stainless-clad steel, glass-lined steel, or chromium-plated steel are recommended materials of construction for the vessel members. Agitator parts can be of Type 304 stainless steel. The high surface finish available with glass-lined and chromium-plated steel are advantageous in offering a surface which tends to resist the deposition of a tenacious polymer film. Both steam and coolant feeds are provided for each jacket, the feeds being thermostatically controlled. The main thermal load is in the removal of the exothermic heat of polymerization. In continuous operation, the entering stream to each reactor is fed into the immediate zone of the mixing units proper. Although the reactors are subject at a temperature of 113 deg. F. to a total vapor pressure of approximately 72 lb. per sq.in. absolute, they are designed for a working pressure range from full vacuum to 150 lb. per sq.in. gage.

BATCH RECOVERY OPERATIONS

After the desired completion of the reaction is attained, it is necessary to remove and recover from the latex product the 9 percent or so of unreacted butadiene and styrene. It is possible to recover only a part of the unreacted material although substantially all of it can be removed from the latex. About 90 percent of the unreacted butadiene is recoverable and somewhat more of the styrene. To permit satisfactory operation under the worst conditions, the recovery system shown was actually designed to handle the amount of butadiene and styrene which would be unreacted, assuming only a 75 percent completion of the reaction.

In batch operation, each group of four reactors is provided with a single blowdown still or tank of 5,000 gal. capacity, identical in basic construction with the reactors, except that each is provided with a steam distillation coil. Each blowdown still is designed to operate over a pressure range from full vacuum to 150 lb. per sq.in. gage internal positive pressure. Each blowdown vessel receives a charge every six hours from one of the four reactors with which it works.

The equipment for recovery of unreacted butadiene is somewhat similar in its operation to the butadiene distillation equipment previously described. The differences derive from the fact that in this case the flow potential between the still and the receiver varies from the beginning of the operation to the end; and because in this case rubber polymer emulsion particles contaminate the vapor.

The changing flow potential between the blowdown still where the butadiene is being distilled off, and the butadiene recovery or storage vessel, where it is being condensed, can be considered as arising from the following conditions. For all computational and practical purposes, the system which is being subjected to distillation can be considered as a three-component system of water,

butadiene and styrene, in two phases, with water as one phase, and a miscible mixture of butadiene and styrene as the other phase. Initially the vapor pressures of styrene and water are negligible in comparison with the vapor pressure exerted by the butadiene at the initial distillation temperature. The mol fraction of butadiene in the butadiene-styrene system is high, roughly 80 percent. As the mol fraction of butadiene falls, however, its partial pressure also falls, since the still temperature is kept constant during the butadiene distillation. To provide the necessary driving force as the butadiene distillation approaches its end, as well as to prevent excessive boiling and frothing during the early stage of distillation, a Nash Hytor type of compressor, acting as a vapor meter and as a butadiene exhauster, is inserted in the line between the still and the condenser. Initially, the compressor serves primarily as a vapor meter, but as the pressure in the blowdown still falls, it provides the necessary flow potential to continue the distillation. A valve on the line leading to the recovery vessel, the thermostically controlled constant still temperature and an arrangement for bypassing from the discharge of the compressor to its intake, provide for adjustment in the rate of butadiene distillation. A compressor of 113 cu.ft. per min. capacity, capable of delivering at a pressure differential of 25 lb. per sq.in., is able to handle the joint load of five blowdown vessels. The blowdown vessels are exhausted to a total vapor pressure of 15 lb. per sq.in. absolute, any exhaustion beyond this resulting, of course, in a carryover of appreciable quantities of water and styrene to the recovery vessel.

In order to prevent carryover of entrained polymer emulsion particles in the butadiene recovery system, two vapor scrubbing units are provided through which the butadiene vapors pass. In the first, the vapors are scrubbed by a spray of a weak solution of acetic acid which exerts a demulsifying action on the polymer emulsion particles, throwing out the rubber particles on the surface of the acid bath. In the second scrubber, the entrained acid vapors are washed out with water. The rubber particles which are thrown down are separated from the recirculated acid by means of traps in the recirculation lines.

After the butadiene has been distilled off, it is necessary to remove and recover so far as possible the unreacted styrene. This is accomplished by the progressive drawing of a high vacuum on the still, allowing the sensible heat of the latex batch to provide the latent heat for distilling the styrene. This operation involves two rather sharply defined stages. In the first stage, mainly the residual butadiene remaining in solution in the styrene and in the rubber polymer is exhausted in dropping from a total vapor pressure of 15 lb. per sq.in. absolute to about 2 lb. per sq. in. absolute. In the second stage the vessel is exhausted from 2 lb. per sq.in. absolute to about 1.6 lb. per sq.in. absolute, and during this period both water and styrene are flashed off. Since the water and styrene form an immiscible system, the relative magnitudes of their vapor pressures do not change as a function of the altering composition of the system, but rather as the temperature of the latex in the stills changes. Approximately a 10 deg. F. drop in temperature of the latex emulsion occurs during driving off of the styrene because of the conversion of sensible heat to latent heat which the evacuation of the stills effects. The driving off of the main part of the unreacted styrene is followed by a steam distillation at 29 in. Hg which is used to disengage mechanically entrapped styrene. The condenser and liquid cooler employed in the recovery system have the same function as the corresponding items described in the styrene distillation system, described above for inhibitor removal.

The problem of scrubbing entrained latex from the styrene-water vapor mixture is dealt with by scrubbing these vapors with a brine spray which "salts out" the stabilizing colloid for the latex (soap) and throws down the polymer particles which are then collected in pump traps in the brine recirculation line. Water scrubbing to remove the entrained saline spray follows. A vertical separating column is employed for the separation of the styrene from the water condensed with it, with which it is immiscible.

CONTINOUS RECOVERY OPERATIONS

When the process is operated on the continuous basis, all five blowdown tanks are not necessary, three being sufficient to handle continuous distillation of butadiene and styrene. This makes it possible in continuous operation to use two of the blowdown vessels as additional polymerization autoclaves. This fact and the greater efficiency in continuous reacting, contribute to the approximately 40 percent additional capacity for continuous as compared with batch operation.

When the removal system is operated continuously, a constant back pressure valve between the last reactor and the continuous butadiene still prevents butadiene from flashing through the system. The continuous butadiene still is maintained at 113 deg. F. continuously. In this case the compressor in series with the butadiene recovery system maintains a constant still pressure of 15 lb. per sq.in. absolute. The stream of latex which has been freed almost completely from butadiene is continuously withdrawn to the continuous styrene and water still under control of a flow controller inserted between the two stills and made responsive to the liquid level in the continuous butadiene still. The steam jet ejector in the styrene flash still circuit maintains a vacuum of 28.4 in. Hg (0.835 lb. per sq. in. absolute), thus giving a pressure differential of 15 –0.835= 14.165 lb. per sq.in. between the two stills, while at the same time it effects the continuous flashing of the styrene-water distillate. In both the continuous butadiene still and the styrene flash still the entering streams are poured from a convenient point on to the surfaces of the liquid phases in the respective stills. Flow from the styrene flash still to the steam still in which the latex is freed of mechanically entrapped styrene is accomplished under a slight difference in pressure level, aided by a gravity head. Again control is by a flow controller made responsive to the liquid level in the styrene flash still. A double receiver assembly in which the lower of the two receivers pulsates in cycles from atmospheric to 29 in. Hg vacuum is employed as a means for discharging the styrene- and butadiene-free latex.

Because of the heat exchange surface that is available in the continuous butadiene still, and because the distillation in the styrene still is effected by flashing, the intensities of frothing and foam entrainment which might be encountered under certain circumstances are the only limitations on the rate of distillation. The ability to select arbitrarily the liquid level which is carried in these stills makes it possible to counter any tendency toward excessive foam entrainment. The frothing problem is rendered less acute than in batch operation owing to the fact that the distillates in both stills are flashed from the incoming streams during their fall to the liquid surface, as well as from the surface of the liquid in the still. On the other hand, in batch operation, much of the evaporation of distillate takes places within the body of liquid in the still, increasing the tendency toward frothing and entrainment as the bubbles break at the liquid surface. Finally, continuous processing with its resultant practically continuous stream of latex simplifies the handling load for successive stages of the process.

Progress of the Salvage Program in Chemical Process Industries

JOHN R. CALLAHAM *Assistant Editor, Chemical & Metallurgical Engineering*

***Chem. & Met.* INTERPRETATION**

How do the chemical process industries conduct their salvage campaigns? The answers, representing what typical plants have found by experience to be the best practice, have been obtained through a recent *Chem. & Met.* survey on the subject. The results, summarized in this report, will aid other chemical plants in organizing and conducting successful scrap-salvage programs.—*Editors.*

How is the best way for a chemical process plant to set up a scrap-salvage program? First, of course, is the question of who should head up the organization in charge of the salvage drive. All of the plants recently surveyed agreed that responsibility should be definite and the program in charge of one man, usually an engineer. The Sharples Chemicals, Inc., plant at Wyandotte, Mich., for instance, has an assistant to the plant superintendent in charge of the salvage program. Another concern places responsibility on the assistant chief engineer, while another gives the job to the plant manager. At the plant of the Southern Alkali Corp. in Corpus Christi, Texas, the yard superintendent has charge of the program with one of his assistants giving full time to a systematic check-up or clean-up inspection to make certain that when materials are available they are placed in the proper channels for disposal.

Should the salvage committee be composed of a representative of each department or division or should the set-up be upon some other basis? Here again, most concerns have found that each department should be represented upon the committee. But there are a few exceptions. One plant, for instance, prefers a one-man committee while another has no committee set-up but places responsibility on each department foreman. The committee at one plant is composed of all supervising employees, while the Bakelite Corp. at Bound Brook, N. J., prefers a staff organization. It is emphasized that, probably more than any other single factor, the set-up and enthusiasm of the salvage committee will determine the success or failure of any scrap program in a chemical plant. Here is the nucleus, the guiding force of the whole program.

Once the set-up of the committee in charge of the drive has been settled, then the problem arises as how to publicize and popularize the program among the employees. It is axiomatic that no drive will be more successful than the enthusiasm it invokes in the rank and file of employees, for these are the people who work out the best ideas and ferret out the hidden pieces and bits of scrap.

PUBLICIZING THE PROGRAM

A few plants have found it unnecessary to publicize the salvage program, but most of them have developed definite publicity schemes. Posters, usually those furnished by the Salvage Section of WPB, are widely used on bulletin boards or placed throughout the plant. In addition to using the WPB posters, the Bakelite Corp. at Bound Brook and Merck & Co. at Rahway also draw and word many additional ones. The pick-up containers used by these concerns and by Sharples Chemicals, Inc., for salvage materials are painted red, white and blue and indicate the materials to be placed in them. Some are inscribed with a conspicuous "V".

Bakelite Corp. and Southern Alkali Corp. publicize their drives by publishing articles in the plant magazines, while the Tubize Chatillon Corp. in Rome, Ga., goes further and prints reports at intervals in the local town newspaper. The Liggett Drug Co. had an excellent idea for organizations of its type when it appointed 400 "waste wardens" and required these to wear armbands and turn in daily reports—but only on scrap paper!

Sharples Chemicals, Inc. in Wyandotte, Mich., besides using posters, bulletin boards and special receptacles, also publicizes its salvage program among the employees by means of "pep" meetings, personal contacts by members of the committee, pledge cards and "Get in the Scrap" lapel buttons for the workmen. One other concern has also found that monthly council meetings are excellent for spreading the word to a large number of employees.

Receptacles are placed by the Sharples Chemicals, Inc., just inside the plant entrance gate for "home scrap" and employees are urged to bring in all scrap from their homes. If quantities or pieces are too large for the employee to handle alone, arrange-

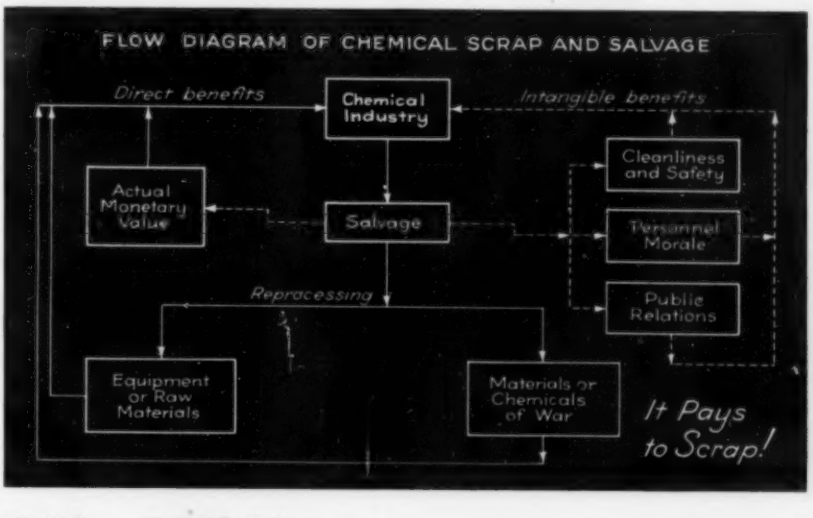


Table I—Results of Scrap Drives in Representative Chemical Plants

All Figures Reported in Thousands of Pounds

Company	1	2	3	4	5	6	7	8	9
Iron and Steel	1,283	448	2,700	622	539	107	250	1,164	190
Lead	257	1		.....	71	.....	9	.....	46
Copper and brass	37	9	129	35	19	.....	7	14	34
Aluminum	0.7	5.4		0.1	11.6	.....	.....	.....	.....
Paper and cardboard	16	214	.....	.....	521	2	110	.....	.....
Rubber	1.5	2.5	14.0	2.9	14.9	1.0	6.0	.....	4.0
Metal containers, units	.....	...	.....	.....	547	.....	10,000	.....	.....
Tin	.....	...	.....	32.5	.....	.....	.....	.....	.....
Burlap and twine	.....	1.8	.....	.....	1.5	.....	.....	.....	6.3

ments are made for a company truck and driver to pick it up. All money derived from the sale of this "home scrap" goes into the Plant Benefit Fund.

WHAT TO DISCARD

Every salvage committee eventually comes up against the problem of defining the yardstick to be used in determining which piece of equipment to discard. In most cases, the salvage committee itself or the engineering division determines whether a piece of equipment will be of more use in the plant or on the scrap pile. One plant has a committee composed of the plant manager, plant superintendent, chief engineer and maintenance engineer to inspect and decide which items are to be discarded. Another procedure is to have each piece of inactive equipment analyzed as to its probable use by the chief engineer, plant superintendent and department heads. If all these agree that it has a probable use within a reasonable time then it is retained, otherwise it is sold as used equipment or as scrap.

Officials of Merck & Co. at Rahway have devised a novel yardstick in deciding what to discard. They take the position that if a piece of equipment has not been used for three months and if a use could not be proved for it in the next three, then that piece should quickly be consigned to the resale market or to the scrap heap. This "realistic" attitude actually resulted in disposal of a number of pieces of unused equipment.

The Southern Alkali Corp. at Corpus Christi, in determining whether or not a piece of equipment should be discarded, answers the following four questions:

(1) Have we any further present need or possible future use for this equipment?

(2) If this item is disposed of, will it have to be replaced?

(3) If the equipment is replaced, will the improved production which will result more than compensate for the vital materials used to produce the replacement?

(4) Can equipment which we are no longer able to use be reconditioned and sold to other users?

This concern continues as follows: "We have found many instances where equipment was obsolete to our plant but had a very definite use value to some other manufacturer. In such cases, we always sell the equipment and thus eliminate the actual waste which accrues when the unit is scrapped and another manufactured for other users." This procedure is not only more profitable than that of indiscriminate scrapping but, of more importance, it indicates a spirit of cooperation and mutual help doubly valuable in emergencies such as the present. This spirit is prevalent throughout the chemical industries.

Success of these salvage drives in chemical process plants is shown by Table I, which gives the various amounts of metals, rubber, paper and other waste collected by nine representative chemical plants picked at random. The same results are being obtained by hundreds of other plants throughout the country. These nine plants alone contributed during 1942 some 3,700 tons of iron and steel, almost 80 tons of copper and brass, about 23 tons of rubber as well as substantial quantities of other strategic materials. It would probably be no exaggeration to say that the total scrap salvaged by the chemical process industries exceeded 100 times the above figures.

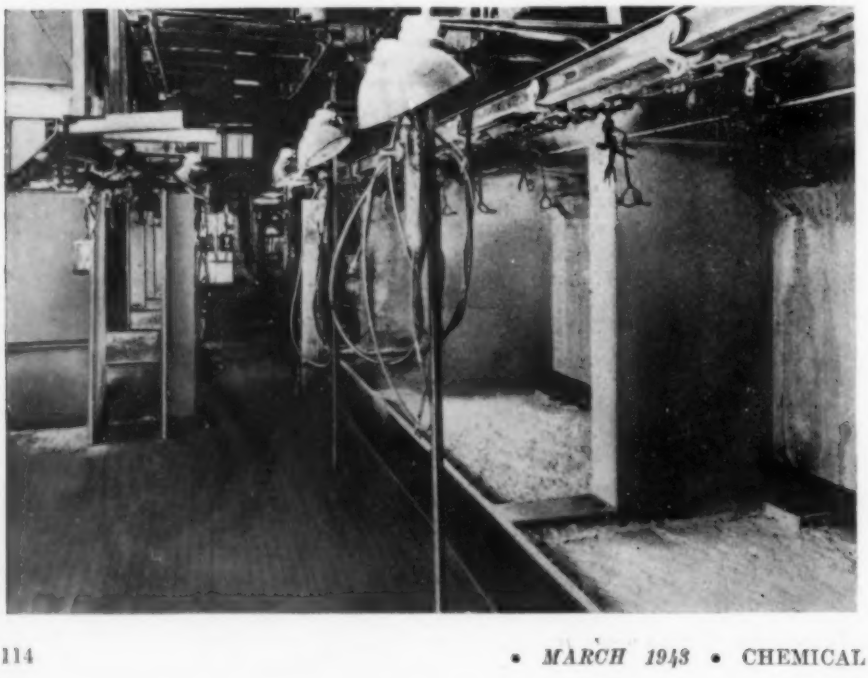
AMOUNTS AND VALUES

More than 7,000,000 lb. of scrap metal were salvaged in one month only from 82 du Pont plants, and this company estimates that its intensified campaign will turn over scrap metal in excess of 100,000,000 lb. this year. Tons of lead and copper are being recovered from sand banks into which shells have been fired on testing ranges. This company often resorts to laboratory analysis to establish beyond question the identity of salvaged metal in the grading and segregation process.

Fifty tons of paper, enough to print 210,000 copies of a regular size 32-page newspaper are salvaged each month from the wastebaskets of the duPont Wilmington home office buildings. These offices return typewriter spools and metal containers to the manufacturer by the hundreds of gross. All scrap from chemical companies need not come from the plants and factories!

Although it is commendable to do so, salvage campaigns need not be motivated purely for reasons of patriotism. *In almost all cases, the actual monetary value of the scrap exceeds by a good margin the cost of collection.* One firm, for instance, reports a 25 percent gain, while the Bakelite Corp. plant at Bound Brook reports a monetary gain of approximately $15,500 for the last nine months of 1942! This plant's drive yielded, among other items, valves, pipes, fit-

A typical finishing conveyor line, showing spray booths with collected paint overspray floating on the surface of the water. See Table II for paint ingredients thus reclaimable for war use during 1943



tings, traps, etc. valued at $7,800.

Southern Alkali Corp. at Corpus Christi reports its monetary gain from salvage as "quite an item" and received during the past year some $6,100 for disposed scrap. The U. S. Industrial Chemicals, Inc., plant at Baltimore obtained over $7,618 for 275,750 lb. of scrap collected during the last seven months of 1942. Labor costs for collecting totalled only $499, so that the actual monetary return amounted to $7,119. Merck & Co. at Rahway report that their active salvage crusade would save the company about $9,000 per year. *Scrap can be a profitable by-product!*

The story of du Pont's huge iron gunpowder-grinding wheels is now familiar throughout the country. Some of these iron wheels, each weighing 7.5 tons, ground out gunpowder at the du Pont Eleutherian Mills from 1814 until 1923. They turned out gunpowder for the North during the Civil War, helped to free Cuba, and ground away against Germany during World War I. Now they are going to the nation's scrap pile as fast as dynamite can blast them apart. There are 28 of these old wheels and 14 base plates, together with supporting gudgeons and operating cogs, totalling considerably more than 350 tons of anti-Axis iron and another reason why Goering undoubtedly swears often at energetic, wily Irenee du Pont for settling on the Delaware Brandywine instead of the French Seine.

Not only metal scrap and rubber are being salvaged, but solvents and other chemicals as well. The Tubize Chatillon plant in Rome, Ga. recovers all solvents, as do a number of other plants. In general, however, recovery of solvents is still not universally practiced even among those plants that regularly use substantial amounts.

Table II—Paint Ingredients Reclaimable During 1943[1]

	Pounds
Pigments	29,573,000
Phthalic anhydride	3,876,000
Glycerine	2,580,000
Oils	5,615,000
Zinc yellow	2,825,000
Glycerol phthalate resin	1,630,000
Phenol formaldehyde	840,000
Damar gum	245,000
Alkyd resins	1,330,000
Chlorinated rubber	238,000
Ethyl cellulose	238,000
Nitrocellulose	491,000
Plasticizers	302,000

[1] From S. Donald Perlman, chief, Chemical Resources Section, Industrial Salvage Branch, W.P.B.

SALVAGE OF CHEMICALS

A recent nation-wide survey of the paint situation, made by the Industrial Salvage Branch of W.P.B., has shown that approximately 50 million pounds of paint ingredients can be saved during 1943 through cooperative action by the paint manufacturing industry and its consumers. Estimated quantities of the various ingredients which can be reclaimed during 1943 are given in Table II.

Most products of the war industries assembly lines must be "mass-painted" by spray painting processes. This is where waste, usually called "overspray", occurs. It is known that about 30 percent of the paint used in these processes can be recovered by well-known methods. In the few years since reclamation methods have been perfected, nearly 3,000,000 gal. of paint have been reclaimed. Approximately 40 major paint and other companies have facilities available.

Metallic sludges and residues from chemical processes are salvaged on a large scale by the duPont plants, and over 10,000,000 lb. of such chemical waste was recovered by this concern in one month alone. The salvage of nylon, however, is the du Pont classic in this war. Several months ago this campaign was launched to salvage nylon waste yarn from textile mills and waste dealers. More recently used stockings have been included in the recovery program. This scrap nylon is actually chemically "unravelled" until the two original raw materials, adipic acid and hexamethylenediamine, are obtained. The recovery process is literally a "synthesis in reverse."

SCRAP DISPOSAL

Experience seems to prove that the best way for chemical process plants to dispose of their scrap is to sell it to the local licensed dealers, who call for the material and cart it away. One plant has two main outlets: the authorized scrap dealer and the local foundries. The latter are glad to purchase cast iron, copper and brass. Any salable used piece of equipment, of course, can be readily sold to any number of reliable second-hand equipment dealers. Reclaimed paint "overspray" should be placed in clean, open-head drums, covered with at least four inches of water and shipped back to the paint manufacturer for reclamation.

MAINTENANCE

(*Continued from page* 100)

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before complete failure of existing equipment takes place. This procedure requires foresight and careful timing and is of great value in keeping production equipment in good operating condition at all times.

(4) The field of alternate materials should be a constant consideration. It may be found that many alternate materials are suitable and even more economical. This information will prove of value now and during the postwar period.

(5) In the actual execution of repairs careless and makeshift workmanship should be avoided. Repairs should be made to ensure a reasonable measure of permanence and eliminate as far as possible frequent repeat repairs. This is economically sound at all times, but mandatory at this time looking to the present and postwar period. The policy of "Patch and Pray" is liable to induce slip-shod workmanship unless adequately controlled.

(6) Admitting that a certain degree of "Patch and Pray" may be necessary in plant maintenance, the extent of this class of repair work should be determined by the maintenance engineer.

(7) Greater effort and closer supervision by maintenance foremen must be exercised to conserve existing facilities, follow up preventive maintenance, ensure good workmanship and keep the plant or factory on a uniformly good standard of maintenance now. This will pay dividends for the present, and greater dividends in the postwar period.

Our unpreparedness before the war to meet the emergency requirements of a wartime economy with conversion to war production has taught us many lessons on the importance of being ready. This experience should impress us with the vital necessity of preparedness to meet postwar demands.

The maintenance engineer is playing a most important part now and will play an equally important part during the reconstruction period after the war. The measure of foresight and ingenuity displayed now in keeping his plant in good operating condition will dictate to a great degree the success attendant upon a smooth process of conversion to peacetime production in a minimum of time. Good maintenance is the keystone of successful production—let the maintenance engineer be ready to handle the job.

PLANT NOTEBOOK

DISK FANS SOLVE TROUBLESOME VENTILATING PROBLEMS IN A CHEMICAL PLANT

WILLIAM J. SHORE, Engineering Consultant, William J. Shore, Inc., New York, N. Y.

DISK AND PROPELLER FANS are often the most economical devices for the solution of difficult chemical plant ventilation problems. Through their use the writer recently had an opportunity to cure some extremely bad working conditions in the plant of a chemical manufacturer who was engaged in making a material which at one stage gave off large quantities of explosive and flammable vapors, at another stage giving off fumes similar to tear gas which were so annoying to personnel that work was all but impossible. In neither part of the operation was it possible to carry out the work under a hood of reasonable size, so that the problem was clearly one of general ventilation of the room where the operation was being conducted.

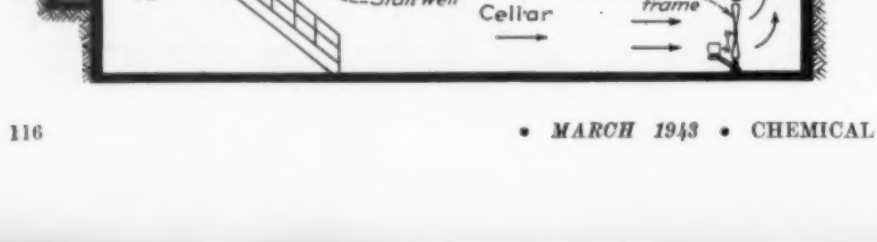
Generally a ventilating problem such as this is thought to require considerable equipment and to run to a good deal of expense. It so happened in the case described, that the building layout in each of the two departments was ideally suited for a simple thorough-ventilating arrangement, with a minimum of equipment. A propeller fan will move more air than any other type of air moving device, with a much smaller power consumption. It requires no ductwork or exhaust stack, and in fact is not satisfactory for use with ductwork since its ability to produce static pressure is decidedly low. By the same token, ample air-inlet area to the ventilated building must be provided, at least four times the area of the fan wheel itself. Otherwise although the fan may appear to be doing its job, actually the air that is pushed out by the fan will immediately be pulled back into the room through open parts of the fan and no appreciable ventilation will be accomplished.

The accompanying illustrations show how the first problem, the exhausting and dilution of the explosive vapors was accomplished. These vapors were produced on the first floor of a building consisting of a single story and basement. Ample openings existed, including several doorways, windows and roof openings. A large stairwell led to the cellar, and at the rear of the cellar was a hoistway leading to the open air, through which drums of material were delivered to and from the cellar. The simplest way of exhausting the air was found to be through the cellar and up the hoistway. However, since it would be necessary to use the latter for its original purpose at times, the fan was mounted in a frame and hung on hinges in the opening from the cellar to the hoistway, similar to a door, so that it could be swung into the opening when the fan was running, or swung back against the wall when hoisting was in progress. In operation, fresh air entered through the various doors and windows, flowed down the stairwell and through the cellar, fan and hoistway.

The content of the building was about 50,000 cu.ft. and a disk fan of 54-in. diameter was selected, run at 365 r.p.m. by means of a 1½-hp. motor and V-belt drive, to discharge about 12,500 c.f.m. of air. Although theoretically this should change the air content of the building completely in about 4 min., perfect mixing of the fumes and air is of course not achieved, and it is necessary to operate the fan from 20 min. to ½ hour each time ventilation is needed. This serves to reduce the fume content of the atmosphere easily to a concentration which is not dangerous.

One interesting feature of the installation is the means adopted to prevent the fan and hoist from being operated simultaneously. A double-throw switch was installed, one side feeding current to the fan, the other side to the hoist. Thus it is impossible to operate both devices at the same time.

Side section of the building and fan installation, showing the air flow paths, the fan and the hoistway used for exhausting fumes from the building



This fan, mounted like a door at the entrance to a hoistway, can be swung out of the way when hoisting, or swung into working position to ventilate fumes from the building

In another part of the plant, certain operations of mixing and transferring chemicals resulted in irritating fumes which made operation almost impossible, even with gas masks. It had been intended to install a complicated and expensive system of ductwork with a centrifugal blower on the roof, but the writer was able to demonstrate that the proposal was not only needlessly expensive, but would not be satisfactory since the fumes were heavy, remaining close to the floor and not mixing readily with the atmosphere. It would have been necessary to hood the entire area.

The room involved was about 50 ft. long, 20 ft. wide and 22 ft. high. At one end was the equipment where the trouble arose, at the other a brick enclosing wall facing a storage yard. In the latter wall was set a 48-in. diameter propeller fan driven by a 3-hp. motor at a speed giving a discharge of 15,000 c.f.m. At the end of the room where the equipment was situated, three openings were cut in the brick enclosing wall, each 2 ft. wide and 6 ft. high and equipped with steel louvers. A window above the new openings increased the entire area for fresh air inlet to 48 sq.ft. To protect against a possible fire in adjoining quarters, the louvers were arranged to close automatically with the fusing of a 165-deg. fusible link.

Since both the fan and the inlet openings were located close to the floor, this made it possible to have a continual flow of fresh air across the lower part of the room which was effective in reducing the concentration of vapors enough that, although they were still somewhat annoying, they were no longer detrimental to the operation of the unit.

CHEM & MET REPORT ON . . .

Maintenance of Electric Lamps and Motors

As the war lengthens and materials necessarily become more and more difficult to obtain, maintenance of equipment becomes a greater problem. All of the resourcefulness and ingenuity of the maintenance engineer is demanded to overcome the obstacles and keep the plant operating at capacity or far beyond "capacity" as is often required under stress of war. In the case of lighting the problem has been simplified for the engineer by the development of the explosion-proof, vapor-proof and dust-proof fluorescent fixtures, non-metallic reflectors, and other fixtures, and in addition new types of lamps. Several practical devices have been designed for making maintenance safe, convenient and economical. A planned maintenance program can prevent one-third of the light loss in an average plant in the process industries.

It has been said that electric motors are the muscles of industry and if they are regularly serviced they will give dependable, long-time service. An ideal motor maintenance program aims at prevention of breakdowns rather than their repairs. Such maintenance involves competent, periodic and systematic inspection of each motor installed on an enforced and established schedule which is in keeping with its vulnerability to breakdown and its relative functional importance to overall production. Several useful tables are included which should prove to be of assistance in servicing motors for they list the troubles, causes, and ways and means for correction.

Lamps and Fixtures

MAINTENANCE OF LAMPS and fixtures is a concern of all industry, but a real problem in the chemical process industries where the vapor and dust laden atmospheres, the splattering and fumes of corrosive chemicals call for special effort if maximum efficiency is to be maintained.

Fortunately for all concerned the problem has been somewhat simplified by the availability of several new developments of the lamp and equipment manufacturers. Metallic reflectors for fluorescent lamps are subject to corrosion. Even the porcelain-enameled steel reflectors are not entirely satisfactory for the enamel chips and once this occurs corrosion commences, soon spoiling the entire reflecting surface. A new non-metallic reflector does away with this nuisance. The wood fiber board reflector covered with a synthetic resin baked finish serves the purpose admirably, although its development was actually prompted by the necessity for substitutes for steel and other strategic metals. It appears quite practical to produce suitable reflectors from such other kinds of non-metallic materials as plywood, paper, asbestos, and plastics.

The degree to which the new synthetic resin finishes will maintain their high reflection factors over a period of years in service is not completely determined as yet, but indications are that some are reasonably satisfactory and will withstand considerable washing and cleaning. At least one manufacturer guarantees against any yellowing or general surface deterioration. The initial reflection factor of the resin finish is of the order of 89 percent as compared to 78 percent for white vitreous porcelain enamel. An important advantage of the synthetic resin finish on the reflector is the ease with which it can be restored by a fresh coat in the shop.

Many chemical plants have been waiting the development of explosion-proof, vapor-proof and dust-proof fixtures for fluorescent lights to convert from incandescent lighting. Units are now on the market that satisfy all underwriters requirements for installation in Class I, Groups C and D, Class II, Groups F and G, Class III, and Class IV hazardous locations. There are also many other locations requiring these units, where hazardous atmospheric conditions are not present but where proper maintenance is the important problem. In such cases, the sealed construction protects lamps and reflecting surfaces from dust and dirt so that efficiency is easily maintained and cleaning costs reduced. These units are available in arrangements for either two or three 48-in. fluorescent lamps.

In cases where it has become advisable to increase lighting intensities due to employment of older workers or to the lengthening of the work day which is tiring on even young eyes, the 400-watt mercury vapor lamp may be added to supplement existing lighting. This type can be installed with

incandescent lamps to prevent stroboscopic effects. This combination has the advantage of resulting in more natural features of the workers.

For close work the "war-hood" has been developed, E. H. Robinson, Nela Park Engineering Department, General Electric Co., reported at a recent meeting of the Illuminating Engineering Society. This utilizes non-metallic materials to a large extent and is especially suitable as a large area luminaire for providing well-nigh shadow-free illumination over a particular area. This unit incorporates plates of configurated glass below the lamps, to reduce the brightness from a "worker's-eye" view. The result is a large-area low brightness source which improves seeing conditions for many industrial tasks. The unit is approximately 8 feet in length and 2 feet in width, with a total of four 40-watt fluorescent lamps. It can be arranged to form an essentially continuous row if desired.

Several luminaires have been designed for the new 4-lamp fluorescent circuit. One employs two reflectors of non-metallic materials end to end, each about 5 feet in length, equipped with two pairs of 100-watt fluorescent lamps. Another utilizes two 5-foot reflectors side by side, each with two 100-watt fluorescent lamps. Among the numerous other new developments is the 3,000-watt mercury vapor lamp, which is particularly suited to high bays.

After selecting the proper method of lighting and the most suitable luminaire, consideration must be given to the maintenance of the lighting system. Engineers generally understand and can properly evaluate the three principal causes for light loss. The first is normal lamp depreciation, the result of the long burning required by three-shift operation. The second is outage. Last, but certainly not least, is the depreciation of installed levels due to accumulated grime.

Because, by proper maintenance, the average plant can obtain approximately one-third more light, it is obvious that grime does not pay. No production executive can afford to neglect the replacement of lamps that no longer give his workers enough light for easy seeing. Nor can he afford to let dust, lint or smoke rob him of light that cleaning can save, and let needlessly lowered lumen output handicap his workers.

Lighting maintenance, therefore, is an important adjunct to production efficiency. Lamps left in important seeing sockets beyond the end of normal life may fail at just the wrong time, and accidents, errors and waste result. Inadequate cleaning can lower levels of illumination by as much as 8 percent a month. Wherever lighting levels are lowered to this extent, the cost of the light lost is greater than the cost of cleaning and maintenance becomes an economic as well as a production necessity.

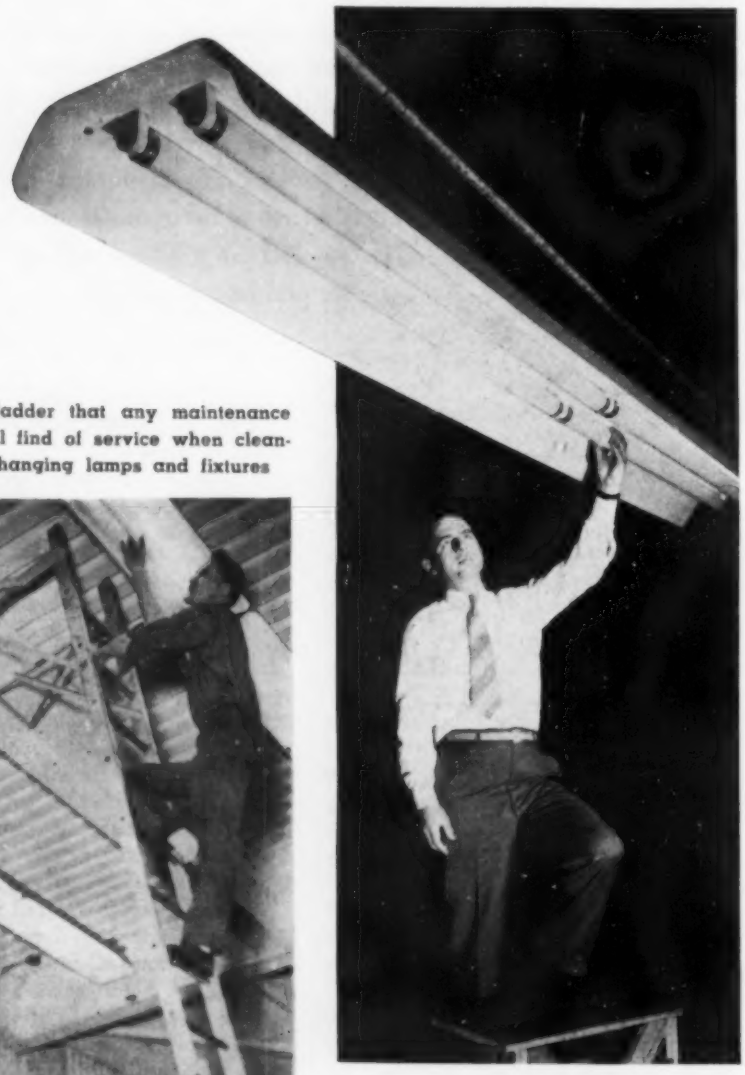
The economy of maintenance based on a detailed survey made in 27 typical war plants has been presented by A. K. Gaetjens, Engineering Department, General Electric Co., Nela Park. Some of the plants were new and had been in operation eight to twelve months. Others in operation for years, had been relighted when they were converted to war work. Some were still producing for war use the same products that they had produced in peace time.

Of the 27 plants surveyed, 23 were lighted with fluorescent. The other four were mercury or filament installations or a combination of the two. Of particular interest is the fact that the ratio of light loss due to grime was approximately the same for all three of the types of lighting represented.

From his study, two principal points emerge. The first demonstrates that improved maintenance can prevent one-third of the light loss in an average plant, as previously mentioned. That fact alone justifies a planned lighting maintenance program. The second point justifies the expenditure of the necessary man time to carry out an adequate maintenance program, establishes the economy of a regular changing schedule.

An average industrial lighting installation is in operation during a minimum of 16 hours a day, seven days a week. Average lamp life can

Here is a ladder that any maintenance engineer will find of service when cleaning and changing lamps and fixtures



A big non-metallic reflector which utilizes the fourlamp ballast. This fiber board reflector may be the answer to the corrosion of the metal ones usually used

be calculated at 2,500 burning hours. Lamps reach 80 percent of normal life, therefore, at the end of about 18 weeks.

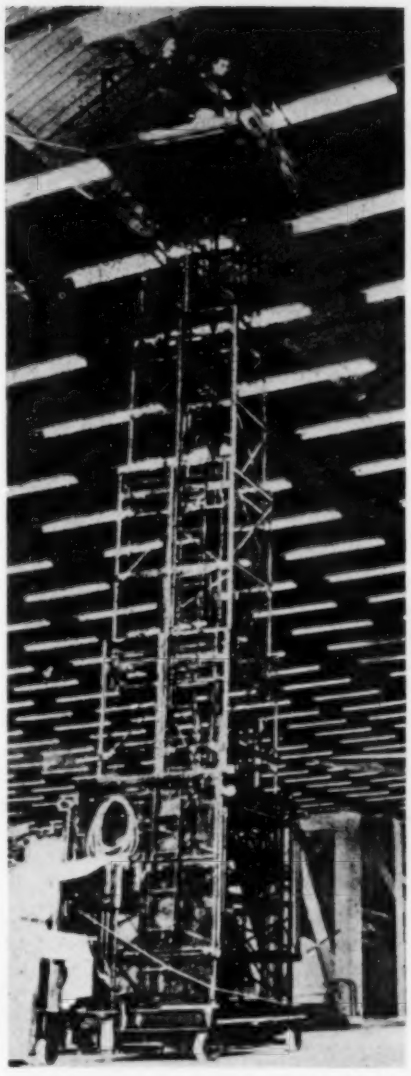
In plants where a large number of fluorescent lamps are installed, the problem of relamping becomes serious unless a program is worked out to anticipate the number of lamps that will fail at a given time. It is impossible to predict when each lamp will burn out, but it is easy enough to predict the number of lamps that will fail in a given group used in any period of time.

Based on lamp mortality curves, with new installations:

1. About half the lamps will burn out at the average life point.
2. A few lamps will burn out early.
3. A few lamps will live far beyond the life expectancy of the group.
4. The rate of failure varies widely, rising gradually to a peak at the average life point, then diminishing as new lamps are installed.

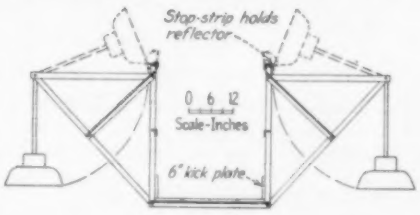
Therefore, the plant with a new installation must have enough men and lamps to meet what will seem like a barrage of outages. An accompanying diagram shows the mortality curve of fluorescent lamps, for new installations. In another diagram, the renewal curve shows that the replacement rate for any given installation varies widely for the first few lampings and then levels out to an average rate determined by the number of lamps, types of lamps, and hours involved. To determine the number of replacements needed on an installation for a month or a year multiply the number of hours burned by the number of lamps and divide the total by the rated hours of lamp life.

Consider a large plant where 10,000 40-watt fluorescent lamps have just been installed to burn 20 hours a day, 25 days a month. The formula (6,000 hours a year times 10,000 lamps divided by an average life rating of 2,500 hours) shows that 24,000 lamps will have to be replaced yearly,



This movable extension tower-platform is a convenient means for servicing the lighting units in a plant

Lamps can be serviced easily by use of this arrangement along the cat walks



or about 2,000 a month after the first few relampings.

But 2,000 replacements a month are only about half the peak replacement rate that occurs at the end of the first 2,500 hours of service and again at approximately 5,000 hours. Hence, whereas 80 lamps a day would be replaced after the replacement curve levels out, more than 130 lamps a day will need to be replaced during the first peak period, about the fifth month. The second peak will come during the tenth month.

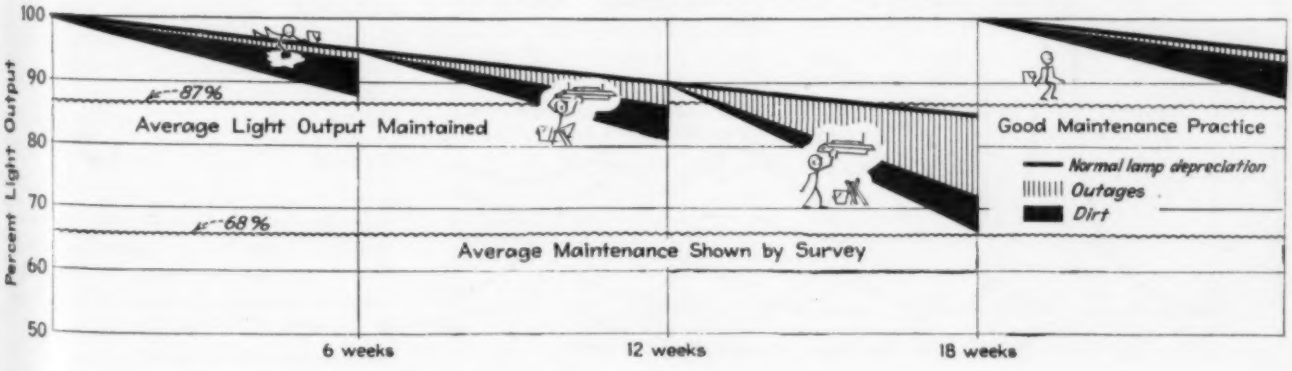
The maintenance engineer must anticipate the average renewal rate, and also plan to handle the peak load when it comes. It has been found that two men can clean 160 reflectors in an 8-hour day. A two-man crew, working five days a week, can clean and relamp five bays a week at a cost of about 12 percent of the total plant investment in lamps, power and retirement of original investment. Also, it has been determined that an average two-man crew can clean and relamp a system that provides lighting for 720 other workmen. The increased light so provided need only to increase the production effectiveness of this group 0.28 percent to pay for itself and the work of the crew.

In practice, group cleaning every six weeks and group relamping at the end of 18 weeks will average 30 percent more light over the whole lighting system. Plant engineers have found that a regular cleaning at six-week intervals shows them a profit.

Production executives, all over the country, have found that high levels of illumination increase the efficient use of men and machines. Production increase of from 3 to 15 percent, increases due entirely to lighting, occur over and over again. The man hours necessary to carry an adequate maintenance program, therefore, certainly can be justified.

The mounting height of a lighting installation naturally determines the equipment necessary to make maintenance safe, convenient and economi-

It is considered good maintenance practice to replace all flourescent lamps at the end of 18 weeks



cal. Here are several different ways to provide for convenient servicing:

1. By ladders. Depending on the mounting height, a stepladder, A-ladder, or straight extension ladder may be used.
2. By crane. Mount luminaires within reach from a crane.
3. By a telescoping portable lift. This equipment is particularly suitable where floor space is sufficiently clear to allow free movement.
4. By automatic disconnecting hangers. They are best suited for mounting heights above 16 feet where no cranes are installed.
5. By cat walks. They may be used where no crane is available and it is desirable to provide access to high mounted luminaires from overhead.
6. By monorails. Such a system can be installed along rows of reflectors to provide easy access from overhead without disturbing floor operations.

No one of these methods is best for all applications, but each has its merits for certain types of installations. Therefore, each installation must be studied carefully to determine the best method of maintenance.

For a low bay installation, hung at 9 to 12 feet, any stepladder that gives the "grime-doctor" a feeling of security and confidence will suffice. If a rack to hold spare lamps and a hook for a spare reflector are added, a good safety step-ladder will prove adaptable, mobile and efficient. As an example of ways to modify existing equipment, a light-weight brace can adapt an ordinary ladder, to give the lamp-changer easier access to the fixtures.

Cat walks provide a convenient method for maintaining lamps and lighting. In one large plant, the lighting fixtures were mounted on messenger cable, below the level of the steel girders which stretch across the building. It was therefore relatively simple to build a wooden cat walk using very little by way of critical materials and simplify the maintenance of the lighting. At mounting heights of more than 30 feet, it is extremely difficult to reach reflectors from the floor. Several practical methods, however, have been developed. Here is pictured a telescoping platform available in a number of sizes. Equipped with outriggers, a tower provides a firm and safe base for operation. Its one drawback lies in the fact that it has to be placed directly under the fixtures which the maintenance crew must reach.

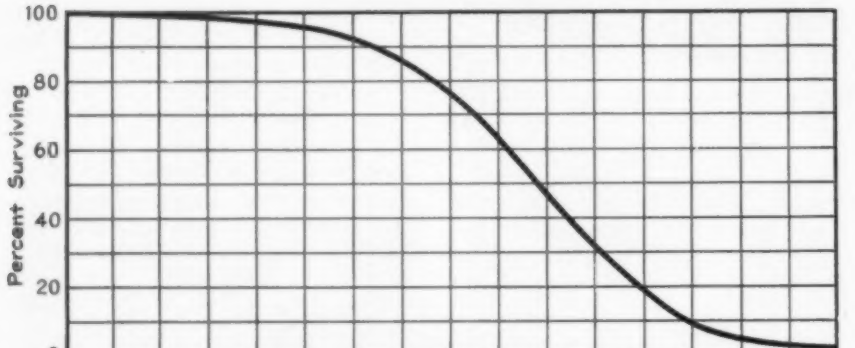
Mobile maintenance ladders mounted on trucks can also service fixtures at extreme mounting heights. The ladder can be swung through various angles completely around its base to reach over stock bins, machines and other obstacles while a truck remains in the aisle. In many plants movable scaffolds or platforms have been built up during the construction period. Two movable towers joined together by a put log can straddle machine or stock bins between two aisles. The difference between the towers can be varied in order to make them relatively flexible.

A few months ago the plant may have had sufficient voltage for the lighting system that was installed. Full rated illumination was obtained at the time from the lamps. Since then electrical machinery may have been added or more lamps installed. If either of these things have been done, voltage on the line may have dropped with the result that lights, whether they be fluorescent or incandescent are not burning at full brilliance.

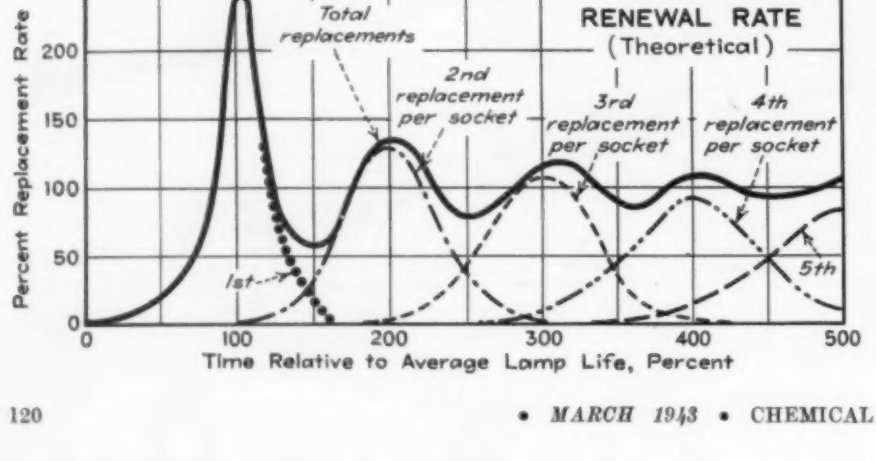
A good plan is to determine the voltage at the time the lighting system is installed, and whenever new loads are put on the plants wiring system it should be checked. This precaution is particularly important with fluorescent installations, since insufficient voltage causes lamps to burn out quicker, operate less efficiently and develop trouble in starting. Fluorescent lamps can not be dimmed, and reduction of as much as 30 percent in line voltage will cause them to black out completely. Lower than rated voltage results in filament lamps burning longer but inefficiently. Overvoltage should be avoided too for greater than rated voltage greatly shortens the fluorescent lamp life, hastens blackening and results in only modest increases in lumen output.

If the original installation of a carefully engineered lighting system was planned to provide adequate light for easy seeing, plant engineers and electricians can certainly justify a simple and economical maintenance program. Maintenance insures more light and more light means an increased quantity and a higher quality of war production.

Fluorescent lamp life follows this curve. Lighting maintenance is an adjunct to production efficiency



Renewal rate for fluorescent installations shows sharp peaks before it levels off to average rate



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Maintenance of Motors

AN IDEAL MOTOR MAINTENANCE PROGRAM aims at prevention of breakdowns rather than their repair. Such maintenance involves competent, periodic and systematic inspection of each motor installation on an enforced and established schedule which is in keeping with its vulnerability to breakdown and its relative functional importance to overall production. Some of the means for maintaining motors in proper operating condition are given below by H. E. Dralle, manager of petroleum and chemical engineering, and W. W. McCullough, maintenance engineer of Westinghouse Electric & Mfg. Co., East Pittsburgh.

Records must be kept consistently on the schedule selected. Several excellent record systems have been developed and reduced to printed form, making it unnecessary to go to the trouble and expense of devising new ones.

Prevention of breakdowns may be helped by a thorough analysis of the equipment involved and by taking precautionary measures against interruptions. For example, if there has been difficulty in the frequent tripping of overload relays, perhaps the installation of a different type of relay or the use of a thermoguard on the motor may enable that particular motor to carry the loads without an injurious temperature rise.

It is impossible to give any hard and fast rules for frequency of inspection. The following suggestions are based on average conditions.

Once a week check the oil level in the bearings and see that the oil rings are moving freely. Check the temperature of the motor bearings and primary iron with the hand. Sniff the warm air coming from open motors. The fumes emanating from overheated insulation are unmistakable.

Once a month check the brush holders, brushes and shunts. Blow out the motor with compressed air.

Once a year check air gap with feeler gage. Check insulation resistance with a megger. Check line voltage with a voltmeter, and load with an ammeter. Clean out and replace grease in ball and roller bearings. Check renewal parts stock in light of the past year's experience.

Every two years dismantle the motor. See that all windings are tight. Replace loose wedges and loose bands before dipping in varnish and baking. Inspect commutators and commutator connections. Sleeve bearings require no flushing. At intervals of about two years in average service, or during general overhaul periods, remove the bracket and wash out the bearing housing. Use hot kerosene oil and compressed air if available.

All motors depend upon a mechanical assembly of some sort for the transformation of electrical energy into mechanical energy or work. The bearings are a very important link in this mechanical assembly. Bearings probably cause more shutdowns, delay and expense, than any other cause.

The first requirement of successful bearing operation is lubrication. This entails more than just an adequate supply of lubricant; the lubricant, the bearing design, and its condition, must be correct.

Sleeve bearings sustain the essential oil film to prevent metal-to-metal contact between the shaft and the bearing surface. Properly designed bearings have adequate area for the load, proper oil grooving, working oil rings, and suitable materials. Two outstanding considerations govern the maintenance of sleeve bearings. First, is to insure the existence of the oil film once rotation has begun. *Use the right oil.* The second is to minimize the destructive effects of metal-to-metal contact when the film is lost, either by accident, or during the starting period. *Use the right babbitt.*

Ball bearings have become increasingly important with the use of totally inclosed and fan-cooled motors so advantageously applied in all branches of the chemical industry.

Common practice in horizontal motors is to use grease lubricated ball bearings although many are applied using oil. Oil bearings are particularly suitable in chemical plants because the oil film protects the steel against pitting due to corrosive gases. Follow the advice of the motor manufacturer in selecting a suitable grease or oil. Soda-base soap greases are usually preferred on account of their high melting point and their stability. They mix readily with water, however, and tend to form an emulsion.

Ball bearings in distress can usually be detected by undue heating or by unusual noise. Broken or nicked balls cause rapid destruction of the bearing. They can be detected by the "clicks."

If the conventional 40 deg. C. rise above the surrounding air is exceeded, look for an overfilled bearing, since the first result of overlubrication is heating. The general rule is that the housing should not be over half full. Clean the old lubricant from the bearing and from the housing once a year and replace it with new.

The air gap in a motor is dependent first on proper maintenance of the bearings and second on the proper alignment of the brackets or pedestals with the frame. A.c. motors operate with less gap than d.c. motors, and are therefore more critical. Check the air gap with a feeler gage at the established schedule period. Make these checks at the pulley end, taking four readings on each motor, 90 deg. apart. For motors below 10 hp., a minimum gap of .005 in. should be maintained. Above 10 hp. the minimum gap should be .010 in.

Where coupled type motors are used such as on acid pumps, the couplings require regular inspection. Faulty coupling alignment is reflected in bearing trouble and vibration. Make sure that all dowel pins are in correct position and check the faces of the couplings with a feeler gage after the belts have been removed. Shift the motor position to make the faces of the two half-couplings parallel.

Flexible couplings will operate under more severe misalignment than solid ones without causing damaging trouble; however, the two halves should be carefully aligned to prevent excessive end thrusts and bearing loadings.

The importance of keeping electrical equipment clean and dry is always worth stressing. Accumulations of dust and dirt not only contribute to insulation breakdown, but they operate to increase the motor temperature through restrictions of ventilation. Dust and dirt are effectively removed with compressed air at about 50-lb. pressure. Do not direct compressed air against the insulation until certain that it is free from moisture that may have accumulated in the air line from condensation. Too great an air pressure may loosen the binding tape or injure the insulation by sand blasting with the abrasive dirt which is nearly always present. It may not be possible to remove all dust and dirt by blowing with compressed air. If the accumulation of dirt contains oil or grease, a solvent will usually be required to remove it.

Totally enclosed motors, totally enclosed fan-cooled motors, and totally enclosed explosion-resisting motors, so widely used in chemical plants, all have the frames sealed so as to exclude

the outside air. They are well protected against the admission of abrasive dirt and metallic particles that shorten the life of insulation in open motors. For these enclosed motors there are two points to observe.

First, see that all exposed joints in the motor frame and brackets are tight. Use a water-resistant grease in the joints where bracket and frame come together, if the motor is dismantled for any reason. This will help to prevent accumulation of water in the bottom of the motor frame.

Second, make sure that on all totally enclosed motors, except explosion resisting, the motor is provided with a drain plug or drain pipe at the bottom of the frame so that any accumulated water can be removed before causing trouble.

D.c. machines add the commutator and its current-collecting details to the general maintenance problem. The armature is the heart of the d.c. motor. Through it flows the main-line current, and if the machine is overloaded the armature is the first to give evidence of distress. When dismantling a d.c. motor for periodic overhauling the following points should be observed. Do not roll the armature on the floor; a coil may be injured or the steel banding wire may be nicked. Support or lift the armature only by its shaft if possible. Never allow the weight of the armature to rest on the commutator or on the coils. Inspect the coils carefully to see that they are tight and where necessary replace the wedges. Replace any bands that may be loose.

As far as possible duplicate the banding originally furnished by the manufacturer. Do not change the material in the banding wire, the diameter of the banding wire, or the width or position of the band. Increasing the band width may cause heavy currents in the bands sufficient to overheat and melt the solder.

The exposed portion of the fron mica V ring is normally a catchall for oil and dirt. This section should be cleaned and protected with a layer of surgical tape and twine to prevent flashovers and breakdown to ground. Red synthetic enamel will give a smooth finish, resistant to oil and carbon dust.

Check the brush rigging carefully. Most brush holders in use today are box type, and the brush holder should be replaced when the inside broached section is worn. The brushes themselves must fit properly, not so tightly as to stick, and not so loosely as to shift position when running. Make sure that the grade used is correct for the application, using the advice of the manufacturer of the motor. Make sure that the fit of the brush on the commutator extends across the face of the brush. The spring tension on the brushes should be uniform so as to prevent selective action.

A gearmotor is a self-contained drive made up of a ball-bearing motor and a speed-reducing gear unit. It is designed for easy handling, to conserve space and to take advantage of the electrical efficiency of the high-

A.C. Motors Trouble Correction Chart

SYMPTOM	CAUSE	WHAT TO DO
Motor stalls.....	Wrong application	Change type or size. Consult maker of equipment
	Motor loaded more than it should be	Reduce load
	Low motor voltage	See that nameplate voltage is applied
	Open circuit	Fuses blown, check relay, starter and pushbutton
	Incorrect control resistance of wound rotor	See that control works in correct sequence, that relays function, replace broken grids
Motor connected but does not start	One phase open	See that no phase is open
	Motor may be overloaded	Reduce load
	Rotor defective	Look for broken bars or rings
	Poor stator coil connection	Remove end bells, locate with test lamp
Motor runs and then dies down	Power failure	Check for loose connections to line, to fuses and control
Motor does not come up to speed	Not applied properly	Consult supplier for proper type
	Too low voltage at motor terminals due to line drop	Use higher voltage on transformer terminals or reduce load
	If wound rotor, improper control operation of secondary resistance	Correct secondary control
	Starting load too high	Check load motor is supposed to carry at start
	Low pull-in torque of synchronous motor	Change rotor starting resistance or change rotor design
	Check that all brushes are riding on rings	Check secondary connections. Leave no leads poorly connected
	Broken rotor bars	Look for cracks near the rings. Usually means a new rotor. Repairs usually temporary
	Open primary circuit	Locate fault with available testing device and repair
Motor takes too long to accelerate	Excess loading	Reduce loads
	Poor circuit	Check for high resistance
	Defective squirrel-cage rotor	Replace with new rotor
	Too low applied voltage	Get power company to increase voltage tap
Wrong rotation at start	Wrong sequence of phases	Reverse connections of motor or at switchboard
Motor overheats while running under load	Check for overload	Remove overload
	Motor may not ventilate properly due to wrong blowers or air shields, may be clogged with dirt	Good ventilation is manifest when a continuous stream of air leaves the motor. If not, check manufacturer
	Motor may have one phase open	Check to make sure that all leads are well connected
	Grounded coil	Locate and repair
	Unbalanced terminal voltage	Check for faulty leads, connections and transformers
	Shorted stator coil	Repair and then check wattmeter reading
	Grounded coil	Locate and repair ground
	Faulty connection	Indicated by high resistance
	High voltage	Check terminals of motor with voltmeter
	Low voltage	Check terminals of motor with voltmeter
	Rotor rubs stator bore	If not poor machining replace worn bearings
Motor does not run in balance after corrections have been made	Motor misaligned	Realign
	Weak foundations	Strengthen base
	Coupling out of balance	Balance coupling
	Driven equipment unbalanced	Rebalance driven equipment
	Defective ball bearing	Replace bearing
	Bearings not lined up	Line up properly
	Balancing weights shifted	Rebalance rotor
	Wound rotor coils replaced	Rebalance rotor
	Polyphase Motor running single phase	Check for open circuit
	Excessive end play	Adjust bearing or add washer
Hot bearings.....	(S & B) No lubrication	Check and replenish lubrication
(S — Sleeve)	(B) Danger of too much grease	Open up caps and remove grease
(B — Ball)	(S) Oil rings sticking	Repair or replace rings
	(B) Broken ball or retainer	Renew bearing
	(S & B) End thrust	Remove thrust from driven apparatus
	(S & B) Misalignment	Realign
	(S & B) Bearings not in line	Line up or replace
Unbalanced line current on polyphase motors during normal operation	Unequal terminal volts	Check leads and connections
	Single phase operation	Check for open contacts
	Poor rotor contacts in control wound rotor resistance	Check control devices
	Brushes not in proper position in wound rotor	See that brushes are properly seated and shunts in good condition
Scraping noise.....	Fan rubbing air shield	Remove interference
	Fan striking phase insulation	Remove interference
	Loose on bedplate	Tighten holding bolts
Magnetic noise.....	Air gap not uniform	Check and correct bracket fits or bearing
	Loose bearings	Correct or renew
	Rotor unbalance	Rebalance

speed motor and the transmission efficiency of accurately cut and properly designed gears. Suggestions already given apply to the motor element of the gearmotor unit.

Proper maintenance, as outlined in the foregoing is important even in normal times. In these times when our war effort is demanding most of our critical materials, our manufacturing facilities and our manpower, the importance of an adequate maintenance program cannot be overstressed. Such a program will do much toward maintaining peak operating efficiency and making existing critical materials last for the duration of the war or longer.

A.C. and D.C. Motor Maintenance Check Chart

TROUBLE	CAUSE	WHAT TO DO
Hot bearings.	Bent or sprung shaft	Straighten or replace shaft
	Excessive belt pull	Decrease belt tension
	Pulley too far away	Move pulley in close to bearing
	Pulley diameter too small	Use larger pulley
	Misalignment	Correct by realignment of drive
Sleeve.....	Oil grooving in bearing obstructed by dirt	Remove bracket or pedestal with bearing and clean oil grooves
	Bent or damaged oil rings	Replace oil rings
	Oil too heavy	Use a recommended lighter oil
	Oil too light	Use a recommended heavier oil
	Insufficient oil	Fill reservior to proper level in overflow plug
	Too much end thrust	Reduce thrust induced by driven machine or supply external means to carry thrust
	Badly worn bearing	Replace bearing
	Overloaded bearing	Reduce load, check cause of excessive bearing pressure
Ball.....	Insufficient grease	Maintain proper quantity of grease in bearing
	Deterioration of grease	Remove old grease and replace with new grease
	Lubricant contaminated	Remove old grease, wash bearings and replace with new grease
	Excess lubricant	Reduce quantity of grease
	Heat from hot motor or external source	Protect bearing by cooling motor
	Over loaded bearing	Check alignment, side thrust and end thrust
	Broken ball or rough races	Replace bearing
Oil leakage from overflow plugs	Stem of overflow plug not tight in oil reservoir	Remove, recement threads and screw in tight
	Cracked or broken overflow plug	Replace the complete plug
	Plug cover not tight	Requires cork gasket or if screw type can be tightened by turning down further
Motor dirty..	Ventilation blocked, stator filled with fine dust	All types of dust may be fine such at cement, sawdust, grain dust, coal duss and the like. Dismantle entire motor and clean each individual coil and part
	Rotor winding clogged	Clean, grind and undercut commutator. Clean and revarnish windings with good insulating varnish
	Bearing and brackets coated inside	Dust and wash clean with cleaning solvent
Motor wet...	Subject to dripping	Wipe motor and dry by circulating heated air through motor. Install drip or canopy type covers over motor
	Drenched condition	Motor should be covered to retain heat and rotor position shifted frequently
	Submerged in flood waters	Dismantle and clean parts. Bake armature in vacuum oven at 105 deg. C. for 24 hrs. Do same to stator. Make sure commutator bush is drained of its water

General Good Maintenance Practices

Keep motor off line when not needed	Saves unnecessary wear of brushes, commutator and bearings, saves lubrication
Do not leave field circuit excited unless motor has been especially designed for this type duty	Check temperature of shunt fields with thermometer to see that temperature does not exceed 90 deg. C. Where field must be excited caution maintenance men to be sure field circuit is killed before trying to work on the motor to prevent accident
Keep motor clear of metal dust or cuttings that can be drawn into windings and pole pieces	Magnetic attraction can draw and hold metal parts into the air gap and damage windings
Reassembling of motor	Be sure to retain original air gaps in motor by checking bore of pole faces when dismantling, and then reassemble keeping poles and liners in same respective position
Note wearing parts and frequent replacement to determine needed repairs	Carry in proper store room the original stock for desired replacement parts. Make survey to standardize all repair parts so that a duplication of parts will not be carried

Trouble Correction Chart for D.C. Motors

TROUBLE	CAUSE	WHAT TO DO
Fails to start	Circuit not complete	Switch open, leads broken
	Brushes not down on commutator	Held up by brush springs, need replacement. Brushes worn out
	Brushes stuck in holders	Remove and sand, clean up brush boxes
	Armature locked by frosen bearings in motor or main drive	Remove brackets and replace bearings or recondition old bearings if inspection makes possible
	Power may be off	Check line connections to starter with light. Check contacts in starter.
Motor starts then stops and reverses direction of rotation	Reverse polarity of generator that supplys power	Check generating unit for cause of changing polarity
	Shunt and series fields are bucking each other	Reconnect either the shunt or series field so as to correct the polarity. Then connect armature leads for desired direction of rotation. The fields can be tried separately to determine the direction of rotation individually and connected so both give same rotation
Motor does not come up to rated speed	Overload	Check bearing to see if in first class condition with correct lubrication. Check driven load for excessive load or friction
	Starting resistance not all out	Check starting to see if mechanically and electrically in correct condition
	Voltage low	Measure voltage with meter and check with motor name plate
	Short circuit in armature windings or between bars	For shorted armature inspect commutator for blackened bars and burned adjacent bars. Inspect windings for burned coils or wedges
	Starting heavy load with very weak field	Check full field relay and possibilities of full field setting of the field rheostat
	Motor off neutral	Check for factory setting of brush rigging or test motor for true neutral setting
	Motor cold	Increase load on motor so as to increase its temperature, or add field rheostat to set speed
Motor runs too fast	Voltage above rated	Correct voltage or get recommended change in air gap from manufacturer
	Load too light	Increase load or install fixed resistance in armature circuit
	Shunt field coil shorted	Install new coil
	Shunt field coil reversed	Reconnect coil leads in reverse
	Series coil reversed	Reconnect coil leads in reverse
	Series field coil shorted	Install new or repaired coil
	Neutral setting shifted off neutral	Reset neutral by checking factory setting mark or testing for neutral
	Part of shunt field rheostat or unnecessary resistance in field circuit	Measure voltage across field and check with name plate rating
	Motor ventilation restricted causing hot shunt field	Hot field is high in resistance, check causes for hot field, in order to restore normal shunt field current

Trouble Correction Chart for D.C. Motors (Continued)

TROUBLE	CAUSE	WHAT TO DO
Motor gaining speed steadily and increasing load does not slow it down	Unstable speed load regulation	Inspect motor to see if off neutral. Check series field to determine shorted turns. If series field has a shunt around the series circuit that can be removed
	Reversed field coil shunt or series	Test with compass and reconnect coil
	Too strong a commutating pole or commutating pole air gap too small	Check with factory for recommended change in coils or air gap
Motor runs too slow continuously	Voltage below rated	Measure voltage and try to correct to value on motor name plate
	Overload	Check bearings of motors and the drive to see if in first class condition. Check for excessive friction in drive
	Motor operates cold	Motor may run 20 percent slow due to light load. Install smaller motor, increase load or install partial covers to increase heating
	Neutral setting shifted	Check for factory setting of brush rigging or test for true neutral setting
	Armature has shorted coils or commutator bars	Remove armature to repair shop and put in first class condition
Motor overheats or runs hot	Overloaded and draws 25 to 50 percent more current than rated	Reduce load by reducing speed or gearing in the drive or loading in the drive
	Voltage above rated	Motor runs drive above rated speed requiring excessive horsepower Reduce voltage to name plate rating
	Inadequately ventilated	Location of motor should be changed, or restricted surroundings removed. Covers used for protection are too restricting of ventilating air and should be modified or removed. Open motors cannot be totally enclosed for continuous operation
	Draws excessive current due to shorted coil	Repair armature coils or install new coil
	Grounds in armature such as two grounds which constitute a short	Locate grounds and repair or rewind with new set of coils
	Armature rubs pole faces due to off center rotor causing friction and excessive current	Check brackets or pedestals to center rotor and determine condition of bearing wear for bearing replacement
(a) Hot armature	Core hot in one spot indicating shorted punchings and high iron loss	Sometimes full slot metal wedges have been used for balancing. These should be removed and other means of balancing be investigated
	Punchings uninsulated. Punchings have been turned or band groves machined in the core. Machined slots	No load running of motor will indicate hot core and drawing high. No load armature current. Replace core and rewind armature. If necessary to add band grooves grind into core. Check temperature on core with thermometer not to exceed 90 deg. C.
(b) Hot commutator	Brush tension too high over load	Limit pressure to 2 to 2½ lbs. per sq. in. Check brush density and limit to density recommended by the brush manufacturer
	Brushes off neutral	Reset neutral
	Brush grade too abrasive	Get recommendation from manufacturer
	Shorted bars	Investigate commutator mica and undercutting and repair
	Hot core and coils that transmit heat to commutator	Check temperature of commutator with thermometer to see that total temperature does not exceed ambient plus 55 deg. C. rise, total not to exceed 105 deg. C.
	Inadequate ventilation	Check as for hot motor
(c) Hot fields	Voltage too high	Check with meter and thermometer and correct voltage to nameplate value
	Shorted turns or grounded turns	Repair or replace with new coil
	Resistance of each coil not the same	Check each individual coil for equal resistance to be 10 percent and if one coil is too low replace coil
	Inadequate ventilation	Check as for a hot motor
	Coil not large enough to radiate its loss wattage	New coils should replace all coils if room is available in motor
	Overheating deteriorates insulation and shortens life of the motor	

TROUBLE	CAUSE	WHAT TO DO
Motor vibrates and indicates unbalance	Armature out of balance	Remove and statically balance or balance in dynamic balancing machine
	Misalignment	Realign
	Loose or eccentric pulley	Tighten pulley on shaft or correct eccentric pulley
	Belt or chain slip	Adjust belt tension
	Mismating of gear and pinion	Recut, realign, or replace parts
	Unbalance in coupling	Rebalance coupling
	Bent shaft	Replace or straighten shaft
	Foundation inadequate	Stiffen mounting place members
	Motor loosely mounted	Tighten holding down bolts
	Motor feet uneven	Add shims under foot pads to mount each foot tight
Motor sparks at brushes or does not commutate	Neutral setting not true neutral	Check and set on factory setting or test for true neutral
	Commutator rough	Grind and roll edge of each bar
	Commutator eccentric	Turn and grind commutator
	Mica high not undercut	Undercut mica
	Commutating pole strength too great causing over compensation or strength too weak indicating under-compensation	Check with manufacturer for correct change in air gap or new coils for the commutating coils
	Shorted commutating pole turns	Repair coils or install new coils
	Shorted armature coils on commutator bars	Repair armature by putting into first class condition
	Open circuited coils	Same as above
	Poor soldered connection to commutator bars	Resolder with proper alloy of tin solder
	High bar or loose bar in commutator at high speeds	Inspect commutator nut or bolts and retighten and return and grind commutator face
	Brush grade wrong type.	See brushes
	Brush pressure, too light, current density excessive, brushes stuck in holders.	See brushes
	Brushes shunt loose	See brushes
	Brushes chatter due to dirty film on commutator	Resurface commutator face and check for change in brushes
	Vibration	Eliminate cause of vibration by checking mounting and balance of rotor
Brush wear excessive	Brushes too soft	Blow dust from motor and replace brushes with a changed grade as recommended by manufacturer
	Commutator rough	Grind commutator face
	Abrasive dust in ventilating air	Reface brushes and correct condition by protecting motor
	Off neutral setting	Recheck factory neutral or test for true neutral
	Bad commutation	See corrections for commutation
	High, low or loose bar	Retighten commutator motor bolts and resurface commutator
	Brush tension excessive	Adjust spring pressure not to exceed 2 lb. per sq. in.
	Electrical wear due to loss of film on commutator face	Resurface brush faces and commutator face
	Threading and grooving	Same as above
	Oil or grease from atmosphere or bearings	Correct oil condition and surface brush faces and commutator
	Weak acid and moisture laden atmosphere	Protect motor by changing ventilating air, or change to enclosed motor
Motor noisy	Brush singing	Check brush angle and commutator coating, resurface commutator
	Brush chatter	Resurface commutator and brush face
	Motor loosely mounted	Tighten foundation bolts
	Foundation hollow and acts as sounding board	Coat underside with soundproofing material
	Strained frame	Shim motor feet for equal mounting
	Armature punchings loose	Replace core on armature
	Armature rubs pole faces	Recenter by replacing bearings or relocating brackets or pedestals
	Magnetic hum	Refer to manufacturer
	Belt slap or pounding	Check condition of belt and change belt tension
	Excessive current load	May not cause overheating but see check chart for correction on shorted or ground and coils
	Mechanical vibration	Check chart for causes of vibration
	Noisy bearings	Check alignment, loading of bearings, lubrication and get recommendation of manufacturer

PROCESS EQUIPMENT NEWS

Synthetic Latex Pump

DEVELOPMENT of a pump designed especially for the handling of the butadiene-styrene mixture which forms chemical rubber latex has been announced by Milton Roy Pumps, 1401 East Mermaid Ave., Philadelphia, Pa. The pump employs this company's typical step-valve design with double ball checks, but is modified slightly to permit handling the latex with minimum turbulence. The discharge checks are spring-loaded for instant seating in handling this particularly viscous material. The pump was developed over a period of two years through close cooperation with engineers of the Goodyear Rubber Co.

The pump employs opposed-end duplex construction, utilizing the suction pressure present in the butadiene-styrene mixing vessel and pumping against a greater pressure on the discharge end. Close plunger-stroke adjustment, for precise control of the volume handled, is one claim for the new pump. Another is that the pump is self-cleaning and non-clogging, requiring cleaning only if it has been shut down for an hour or more. Capacities up to 3,000 g.p.h. are available.

Synthetic rubber latex pump

Foot-Operated Control

TO ENABLE an arc welder to speed up his work and do a more accurate job, Lincoln Electric Co., Cleveland, Ohio, has developed a unique type of arc welding control, known as the "Lincontrol," which is strapped on to the welder's foot and enables him to move about with it freely. Although designed especially for aircraft welding, the new control is equally applicable to the welding of light-gage sheet metals of all kinds.

In order to operate the current control, the welder, with the pedal strapped to his foot, merely presses down on the pedal to increase the current. The method is claimed to permit very accurate control over the welding arc, achieving in one unit the same results as both the so-called "hot-start" and "crater eliminator." Having complete control, the welder can adjust the arc at any time without changing his position, yet he can move around at will without having to keep his foot continuously in one place as is necessary with conventional foot controls. He is thus enabled readily to take care of adjustments required by minor changes in thickness and fit-up, thus reducing the danger of a weld burning through, or producing poor fusion or penetration.

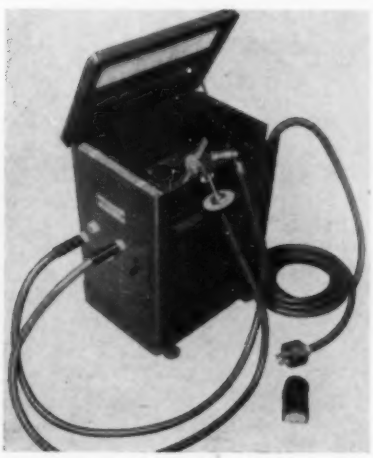
Foot control for welder

Metal Spray Improvement

TO PERMIT metal surfaces to be prepared for metal spraying by a quick and easily mastered electrical process, the Metallizing Engineering Co., Long Island City, N. Y., has developed the new Fuse-Bond process which is claimed to provide a perfect bond on even the hardest surfaces for subsequent metal spraying. The process is thus suitable for preparatory work on metals which were heretofore impossible or impractical to prepare by sand blasting or rough threading. It also simplifies preparation of narrow edges, flat areas and cylindrical parts having keyways and other interruptions in their surfaces.

The process is applied by the new Metco Fuse-Bond unit which operates on any 110- or 220-volt single-phase circuit.

Preparation unit for metals to be metal sprayed



The equipment fuses a rough deposit of electrode metal on to the surface to be metallized, electrodes being applied to the work with a special holder which uses up to six electrodes at one time, depending on the size and nature of the part to be prepared. Small parts, it is stated, can be prepared as easily as large shafts, since there is no excessive heating of the base metal or disturbance of its physical characteristics.

The new unit is compact, being contained in a cabinet measuring only 24 in. high and weighing but 170 lb. Cables and attachments fit into a bin on top of the cabinet, which is mounted on castors for portability.

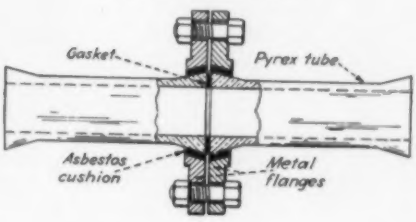
Industrial Glass Tubing

HEAVY-GAGE PYREX glass tubing, in sizes of ¼, ⅜, ½ and ¾ in., and equipped with standard Corning-type flanges of cast iron, is now available in standard and special designs from Fischer & Porter Co., Hatboro, Pa. The tubing is produced in straight lengths, tees, elbows, crosses, U-bends, short nipples, reducers and a variety of other standard fittings, as well as special designs manufactured to order. It is claimed to withstand 400 lb. per sq.in. working pressure in lengths up to 1 ft. and even in 6 ft. lengths to take 140 lb. per sq.in. pressure. It is being offered by the manufacturer as a suitable substitute for unobtainable small-size metal piping for severe industrial service. The manufacturer also is prepared to supply a Pyrex stop cock for working pressure equal to that of the piping, as well as a special design of glass check valve. Tubing and standard fittings are carried in stock and are available on low priorities.

Plastic Respirator

U. S. BUREAU OF MINES approval has been given to a new model of Dustfoe respirator manufactured by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa. This respirator was formerly made of aluminum but is now available in an all-plastic model. The plastic employed is transparent and light in weight as well as durable, odorless, electrically non-conducting and unaffected by corrosion. The transparent feature makes possible in-

Pyrex tubing and joint



spection of the filter for proper insertion and seal without removal of the respirator.

The unit is designed for protection against pneumoconiosis-producing, nuisance and toxic dusts. Its sponge rubber face cushion is said to make it easy to wear while its Army-type exhalation valve provides immediate drainage of condensate from the facepiece.

Steel Processing Coils

FOR USE in industrial processing, a new line of steel heating coils has been announced by Modine Mfg. Co., Racine, Wis. The line includes standard coils and steam distribution type coils, the latter for use where sub-freezing inlet air is introduced. These coils save critical copper and its alloys for vital war production needs, employing steel construction throughout. For protection against corrosion, the entire coil element is dipped in a special lead-alloy bath. The tubes have heavy wall thickness to insure maximum resistance to internal steam corrosion. The fins are permanently bonded to the tubes with metal to insure permanent contact and prevent reduction of the original heat transfer capacity. Use of die-formed fins give effective turbulence, according to the manufacturer, with a minimum of air resistance. These coils are guaranteed to withstand hydrostatic pressure to 500 lb. per sq.in. or operating steam pressures to 150 lb. per sq.in. A variety of sizes are available in widths to 37¾ in. and lengths to 10 ft. 8½ inches.

Temperature Test Machine

THREE TEMPERATURE RANGES are available for testing instruments, batteries and materials in the new Kold-Hold "Hi-Low" machine manufactured by the Kold-Hold Mfg. Co., Lansing, Mich. The temperature ranges include —60 to +170 deg. F., —80 to +170 deg. F., and -40 to + 170 deg. F. In the —90 deg. model, for example, a temperature drop can be achieved from an ambient of +80 deg. to —60 deg. in 45 minutes; to —70 deg. in one hour, to —80 deg. in 85 min., and to —90 deg. in 140 min. Heating from —90 deg. to + 170 deg. F. requires 90 min. The machine is self-contained and requires only a source of electrical power. The strip heaters are located in the air stream for defrosting and rapid heating. Finned type cooling coils are used for cooling operations, employing a 4, 7½ or 10 hp. two-stage, air-cooled refrigeration machine.

High-Lift Drum Carrier

FOR PLACING 55 gal. drums on skids, scales and platforms, or for removing them, Ernst Carrier Sales Co., 1456 Jefferson Ave., Buffalo, N. Y., has announced a new 14-in.-lift drum carrier with built-in brake and easy-lift features. The built-in brake provides for smooth and easy lowering of the container from the top 14-in. position. To raise the container a full 14 in. off the floor, the handle is lowered from its upper position to horizontal, at which point it locks automatically. By unlocking the handle and applying the brake, the container is lowered to the floor. The new carrier has a capacity of 700 lb., and is said to save floors and to lengthen the life of the containers handled, while permitting one man safely to do a job formerly requiring several.

Circulation Pump

A NEW TYPE of pump available in several sizes for liquid circulating purposes has recently been announced by Ingersoll-Rand Co., 11 Broadway, New York, N. Y. Included in the line are ¾- and 1-in. side-wall-mounted types, a 1¼-in. side-wall-mounted type for low-submergence applications, and a 1¼-in. horizontal type. The side-wall type is shown in an accompanying illustration. The pumps are said to be particularly suitable for providing a constant supply of cooling liquid, or for use in evaporative condensers, air-conditioning units, washers, etc.

Worm Reducers

ANNOUNCEMENT has been made by the DeLaval Steam Turbine Co., Trenton, N. J., of a line of small worm-gear speed reducers with one-piece casings, available for ratios from 3¾ to 1, up to 60 to 1, and in 3-in. and 3½-in. center distances. The casings for these reducers are cast in one piece, with side plates, totally inclosing the working parts as well as serving as an oil reservoir from which the bearings and gear teeth are lubricated. Accessibility is obtained by removing one of the side plates. The worm shaft is carried on ball bearings and the wheel shaft on tapered roller bearings. Carburized nickel steel is used for the worm and worm shaft, and chill-cast bronze for the worm wheel.

Vertical Rotary Pump

A NEW vertically mounted rotary pump, equipped with a 15-hp. gearhead motor, is now being built by the Blackmer Pump Co., Grand Rapids, Mich. Although developed primarily for pumping diesel engine fuel on combat and escort vessels, the unit is said to be equally well adapted to industrial plant use in the transfer of oils and other non-abrasive liquids, owing to its small floor space requirement. The capacity of the pump is 100 g.p.m. at a pressure of 100 lb. per sq.in., when handling diesel fuel. Its construction is of bronze. The gearhead motor operates at 1,770 r.p.m., reducing to 440 r.p.m. on the drive shaft. The pump base is of fabricated steel, designed for bottom and back anchorage in mounting.

Steel Safety Ramp

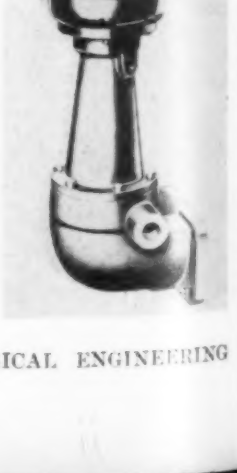
THE MOST RECENT adaptation of the steel safety treads made by Morgan Mfg. Co., 5105 West Lake St., Chicago, Ill., is a safety plate ramp provided with perforated holes, punched through the top of raised buttons. The manufacturer explains the design by pointing out that holes "cannot wear out" and that the edges of the holes cannot become dulled as they wear down. The sharp edges of the holes provide a gripping action, allowing oil, water and other light liquids to drop through, thus making the ramp practically self-draining and removing one of the most frequent causes of slipping accidents. This metal ramp can be supported at the center or it may be stiffened with turned-down edges to make a salf-supporting portable or stationary ramp or plate.

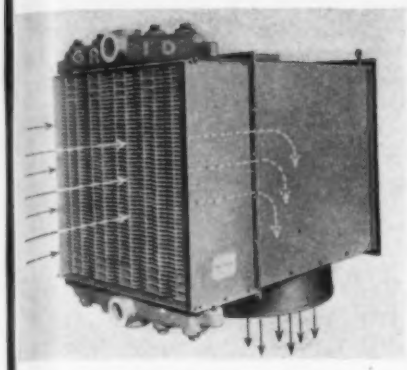
Steel heating coil

Model 3600 HL Kold-Hold machine

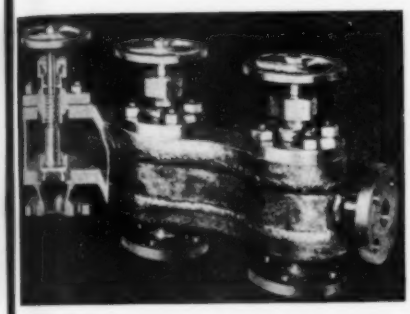
14-inch-lift drum carrier

Side-wall pump





Down-blow Grid unit heater



Welded manifold with three valves

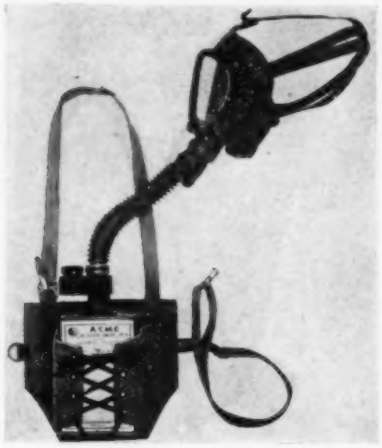
Unit Heater

IN A MODIFICATION of its Grid unit heater, whose heating sections are made of high test cast iron in order to save strategic materials, the D. J. Murray Mfg. Co., Wausau, Wis., has adopted the down-blow principle to heat areas beneath the unit and to protect the motor from the radiant heat of the unit itself. As shown by the arrows in the accompanying illustration, air is drawn into the unit horizontally, and then is discharged vertically downward. The heating unit is said to be free from electrolytic corrosion since each fin heating section is of high test cast iron, cast in one piece, so that only one type of metal comes in contact with the steam or condensate.

All-Purpose Gas Mask

ANNOUNCEMENT has recently been made by Acme Protection Equipment Co., 3616 Liberty Ave., Pittsburgh, Pa., of the fact that Bureau of Mines approval has been accorded to this company's newly improved full-vision all-purpose gas mask. The improved mask combines protection against carbon-monoxide, as well as all other gases, with complete protection against smoke, according to the manufacturer. The mask is, therefore, stated to be particularly suitable for use in fire-fighting. The design permits full vision, both sideways and downward, and particular care has been taken to insure complete exhausting of dead air, and to make certain of a correct fit without "pressure points" on the forehead or temples. An automatic timer is provided to show how much of the canister life remains. The canister is designed for two hours of actual service any time within one year after it is put into use. A particular point with this canister is its ability to filter out from 95 to 100 percent of any smoke, fumes, mist, or fine dust which may be present, in comparison with the 50 percent effectiveness on smokes required of universal type canisters.

Portable electric car spotter



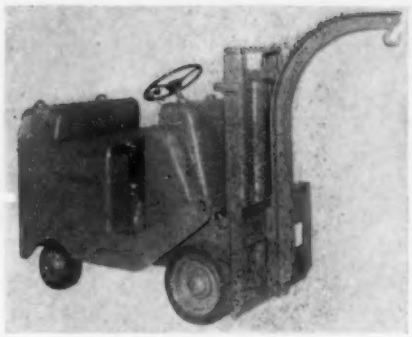
Improved all-purpose gas mask for smokes as well as gases

Welded Manifold Valve

TO PERMIT the simplification of valve and piping hook-ups, Zallea Bros. & Johnson, Wilmington, Del., has introduced a line of welded manifold valves of which a typical example is shown in an accompanying illustration. Any number of valves of any type, in any size, and of any desired construction material, such as carbon or stainless steel, chrome-iron, nickel, Monel, or other alloy, can be combined in an integrated unit to meet any requirements. The arrangement is said to afford greater strength with less weight, and with economy of space, ease of installation, minimum pressure drop and the elimination of bolts, gaskets, and flanged fittings between individual valves.

Portable Car Spotter

LINK-BELT Co., 2410 West 18th St., Chicago, Ill., has now developed a line of portable motorized electric car spotters. This type of equipment was formerly supplied by the company only in stationary mountings. The spotter is so balanced on a channel iron frame that one man can lift one end and roll the unit to any desired location. The operator need then but anchor the frame with a chain, as shown in the illustration, plug in an electric cord, hook one end of the haulage cable to the car or object to be moved, wrap the other end around the capstan, turn on the motor and feed away the cable while the machine does the actual pulling.



Crane-arm lift truck

Lift Truck Attachment

FOR MAINTENANCE about the chemical plant, as in transporting pumps, motors and other equipment to and from the shop, the Towmotor Co., Cleveland, Ohio, has developed a specialized attachment for its fork trucks. The attachment may be used either with or without the fork, and is quickly demountable and interchangeable with standard forks so that the truck can be diverted to special handling assignments in a few minutes, without seriously interrupting regular flow of materials. As shown in the accompanying illustration, the attachment comprises a crane arm installed on the regular lifting mechanism.

Equipment Briefs

A CONSTANT TEMPERATURE cabinet, for temperatures in the range from —90 deg. F. to +220 deg., for use in smaller scale applications where a working chamber of 2 ft. cube is large enough, has recently been developed by American Instrument Co., Silver Spring, Md. A second model is made for the range from zero to —90 deg. The manufacturer claims a temperature constancy within ½ deg. F. The cabinet is portable and supplies refrigeration by means of dry ice. Electric LoLag heaters are used for the high-temperature range. Transfer of heat either to or from the working chamber is accomplished by air, circulated by means of a motor driven fan.

AS A RESULT of three years of research, B. F. Sturtevant Co., Hyde Park, Boston, Mass., has developed and announced a new all-steel heater tube, consisting of a standard steel pipe to which is applied a spirally wound tapered fin. The fin is shaped in cross-section so as to equalize heat intensity at every point along its section. Fins are smooth, without crimping, so as to minimize air resistance and dust accumulation. This heat transfer tube was developed

primarily for applications requiring an all-steel element, and not as a substitute for the scarcer metals ordinarily employed. Tubes can be assembled by the manufacturer into headers to give a unit of any desired heat transfer area.

ACCORDING to Philadelphia Quartz Co., 121 South Third St., Philadelphia, Pa., tight barrels of oak or gum can be used for the transportation of such liquids as cottonseed oil, linseed oil, soap, lubricants and strong alcohol if coated internally with a solution of silicate of soda which is fairly concentrated but still not too viscous to penetrate the pores of the wood. The barrel is first tested for soundness by rolling it while it contains a few gallons of hot dilute silicate solution. A stronger solution is then introduced and the barrel rolled, sometimes along a "scalloped" track which lifts one end and then the other so as to throw the solution effectively over the entire surface. After drying the barrel is ready for use. The method is an old one, but is again becoming important owing to the present shortage of metal drums.

A NEW WOOD-SOLE safety shoe especially designed for women workers in war factories has been announced by the F. J. Stahmer Shoe Co., Davenport, Iowa. The shoe is an oxford of good appearance, having a sole of close-grain maple cut with the proper rock for ease in walking and correct arch support. A composition lift on the 2-in. heel eliminates noise. Safety toes are available, if desired.

Rotary Classification Filter

WHAT IS SAID to be a sturdier design than has heretofore been used is now incorporated in a new rotary-leaf clarification filter manufactured by Swenson Evaporator Co., Harvey, Ill. The new specially designed leaf produces a uniform tautness of the screen, thus giving longer screen life and eliminating the customary clamping rings and bolts, according to the manufacturer. The element illustrated contains 40 leaves of 44½-in. diameter and will be used for the clarification of 50 percent cooled electrolytic caustic solution to give a polished filtrate.

Reset Timer

TWO NEW MODELS of timer, designated as RS4 and RS5, have been put on the market by the R. W. Cramer Co., Centerbrook, Conn. These are synchronous-motor-driven timers of the reset type, available for time ranges up to 5 hours, or longer if desired. They repeat their time cycle upon manual operation of a built-in start button, and indicate at a glance, by means of a progress indicator, the expired and unexpired time cycle as well as the setting time. The first mentioned model has a double-throw switch and opens or closes the circuit, depending on the choice of circuit. It starts by pressing and then releasing the start button which also resets the timer. The second mentioned model is mechanically held in neutral position when the button is pressed and starts the timing cycle by pulling the start button outwardly. These timers will control a ⅓-hp. motor load, a heater load up to 1,200 watts or a lamp load up to 250 watts. Both models are designed for flush panel mounting and can be supplied in dirt- or moisture-proof housings, as well as explosion-proof cases.

Copying Machine

EXACT COPIES of anything which has been written, typed, printed, drawn or photographed, in sizes up to 18x22 in., can be made quickly and easily, according to the manufacturer, through use of the Photocopy machine recently announced by American Photocopy Equipment Co., 2849 No. Clark St., Chicago, Ill. The manufacturer claims that these machines are able to produce copies without a darkroom and without skill or technical knowledge on the part of the operator, thus permitting users to simplify paper work through ready duplication of government reports, statistics, orders, blueprints and tracings. The equipment involves no maintenance cost and operating cost is in proportion to the size of copy being reproduced. An important consideration, according to the manufacturer, is the ability to release important equipment such as typewriters and drafting equipment for other uses while at the same time the copies produced are exact and hence require no proofreading or comparison with the original.

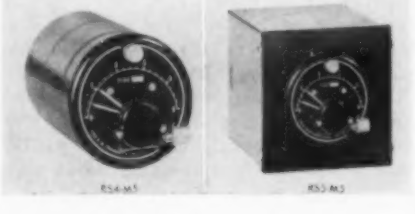
Chemical Cartridge Respirators

AN IMPROVED LINE of chemical cartridge respirators has been introduced by H. S. Cover, South Bend, Ind., for protection against mild concentrations of nuisance gases and organic vapors. The new unit is not a gas mask, but is stated to give adequate protection against paint and lacquer sprays, as well as many chemical fumes, and smoke. The respirator is light in weight, consisting of a molded rubber facepiece applied over the mouth and nose, with an adjustable headband holding it firmly in place. The design is such as to avoid interference with goggles or spectacles. The chemical cartridges are contained in colored plastic cylinders, the A type, in white, containing soda-lime for light concentrations of acid gases; the B type, in black, containing activated charcoal for protection against such operations as brazing and spraying, and against light concentrations of organic vapors; and the AB type, in yellow, containing both soda-lime and activated charcoal, for use on combinations of acid gases and organic vapors in light concentrations, as well as pickling and smelting processes, and the manufacture of leather, textiles, dyes and soaps.

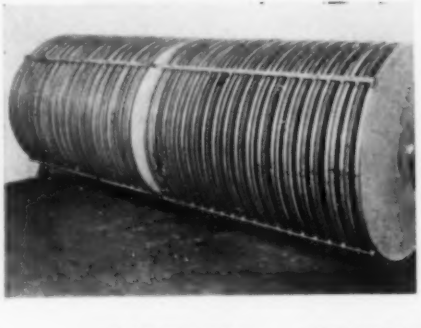
Trailer Truck

DESIGNED to speed up materials handling in large volume, a new Weld-Bilt trailer truck has been put on the market by West Bend Equipment Corp., West Bend, Wis. It is intended for industrial applications requiring long truck trains used in combination with tractors. The truck is heavily constructed for hard use, having a continuous unit angle frame rounded at the corners, roller bearing wheels and double ball-race swivels to assure easy mobility. A special feature is the company's new trailer hitch which couples automatically on impact and can be released by simply pressing the latch at the top of the hitch with either hand or foot. A variety of sizes and types are available.

New reset timers



40-leaf rotary filter unit



Trailer hitch trailer truck

Copying machine in use

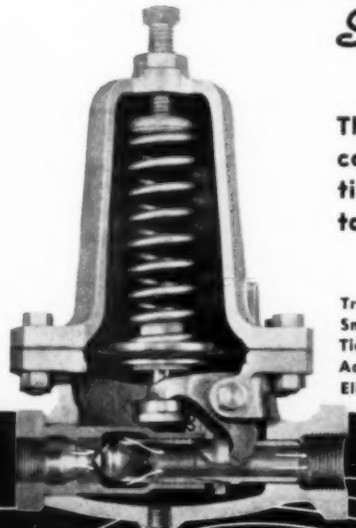
A LONG LIFE and a busy one..

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVE**

●Long life, and busy too, because this type "1000" valve does not fail—it's as dependable when production continues at high rate, like today, as when things are normal. Streamliners in thousands of plants these past years—and still serving well proves this. One user wrote, "We could not afford to take chances on time out for job repairs, that is why we used your valve on this job."

No trouble from lack of capacity with this valve! Even under peak load, or sharp changes in demand, the aspirating effect gets the valve wide open for maximum flow. Users know this and will vouch for it.

Write today for Bulletin 1000—eight pages of valuable valve facts.



Streamline Design means

LESS MECHANISM

The elimination of small ports and passages and complicated mechanism with but few close fitting parts gives you more in service and adds to the life of the "1000" valve.

NET RESULT TO YOU

- Trouble-free service
- Smooth operation
- Tight closure
- Accurate regulation
- Elimination of failures
- Constant delivery pressure
- No spoilage
- Practically zero in maintenance costs
- Speedier production results
- Cost saving operation

TURBULENCE ELIMINATED
The streamlined form of the inner valve produces the flow pattern shown here. It is the reason users of the "1000" valve get maximum capacity when it is needed most and accurate pressure control even when production hits non-stop proportions and operating conditions really are tough.

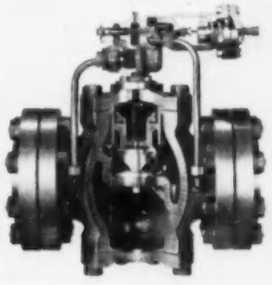
A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS.. VALVES

A CASH STANDARD "GET ACQUAINTED" COLUMN

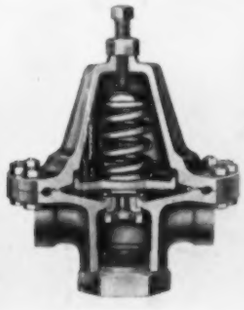
Question: "Don't you people make anything besides that Streamlined Valve you talk about so much?"

Answer: "Yes Sir; we do! And we propose to picture one or two of them here each time."



Cash Standard Type 11 Regulator, for use with water, air or any gas or oil that is non-corrosive. Pressure to actuate pilot valve may come from any source; and be as high as 1500 lbs. Variety of uses, notably as condenser water regulator.

Inlet pressure up to 600 lbs.; outlet pressure up to 250 lbs. Bodies: iron, bronze, steel. Trims: iron, bronze, stainless steel. Screwed, flanged, or ammonia type ends. Sizes: 2" to 12"



Cash Standard Type 8871 Pressure Reducing Valve; for use with liquids—especially dirty liquids, like Bunker C fuel oil for example. No sliding fits; inner valve bolted to diaphragm for positive movement.

Initial pressure up to 250 lbs., reduced pressure up to 200 lbs. Bodies: iron, bronze or steel. Renewable inner valve and seat ring, stainless steel. Sizes: ½" ¾", 1".

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White Lead Processes

SEVERAL PROCESSES are used for converting lead into basic lead carbonate or white lead for compounding into paint. Two of these processes, the old Dutch and the Carter will be briefly described. The accompanying flowsheet shows these processes in operation in a plant of the National Lead Co.

In the Dutch process, pig lead is melted and cast into buckles, which are placed in earthenware pots and stacked in a deep pit. Between each of the ten layers of pots is spent tanbark. Each layer in the stack is connected to a flue through which fumes from the decomposition of the tanbark may escape. The heat formed continues for four months volatilizing acetic acid in the pots and liberating carbon dioxide required for transformation of the lead to the carbonate.

Buckles are removed to a beater, a cylindrical screen, in which they are tumbled to free the larger particles of unchanged lead. Screened material goes through the corrugated rollers. Screening follows—at first with screens of coarse mesh and then with finer mesh. Water grinding is carried out between stones—the fine product going to the drag box. As the mixture of water and white lead flows the length of the box, smaller and lighter particles flow over the lower end. Heavier particles are reground. The slurry passing over the end of the box goes into a series of rake tubs where the coarser particles are removed. The fine white lead floats on a screen of silk bolting cloth. The water is separated in tubs and in pulping machines. The white lead is then ready to be ground in oil and packed for shipment.

Instead of calling for corrosion of buckles in the stacks, the Carter process employs finely divided lead and a method of quickly bringing acetic acid in close contact with the granules. A current of flue gas, rich in carbon dioxide, passes through the cylinders in which dilute acetic acid has been sprayed on the granules, and the transformation of basic lead carbonate takes place. White lead is thus produced in 12 days.

CHEMICAL & METALLURGICAL ENGINEERING

March, 1943

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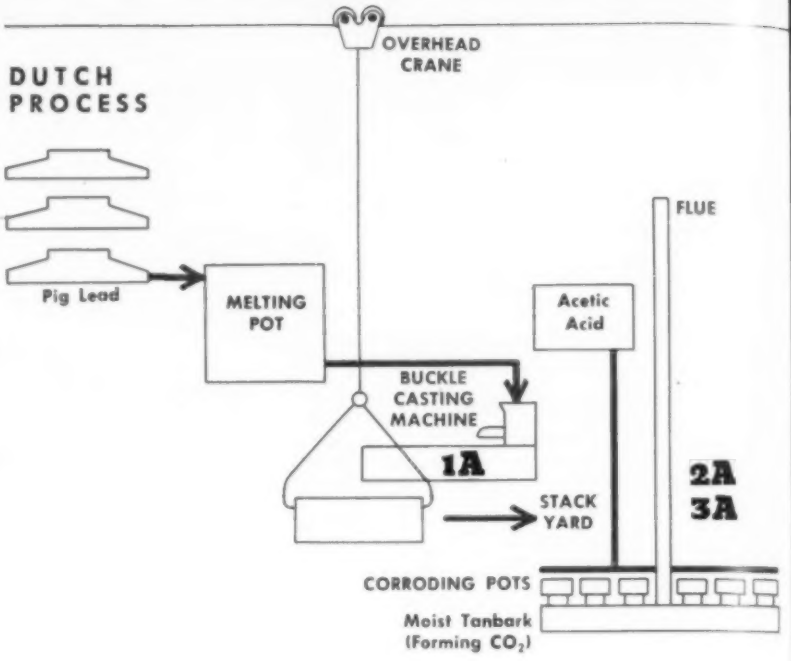
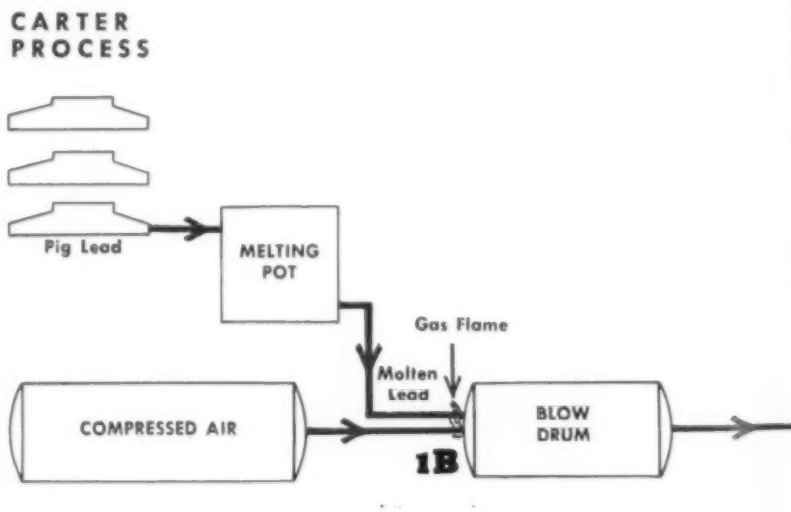
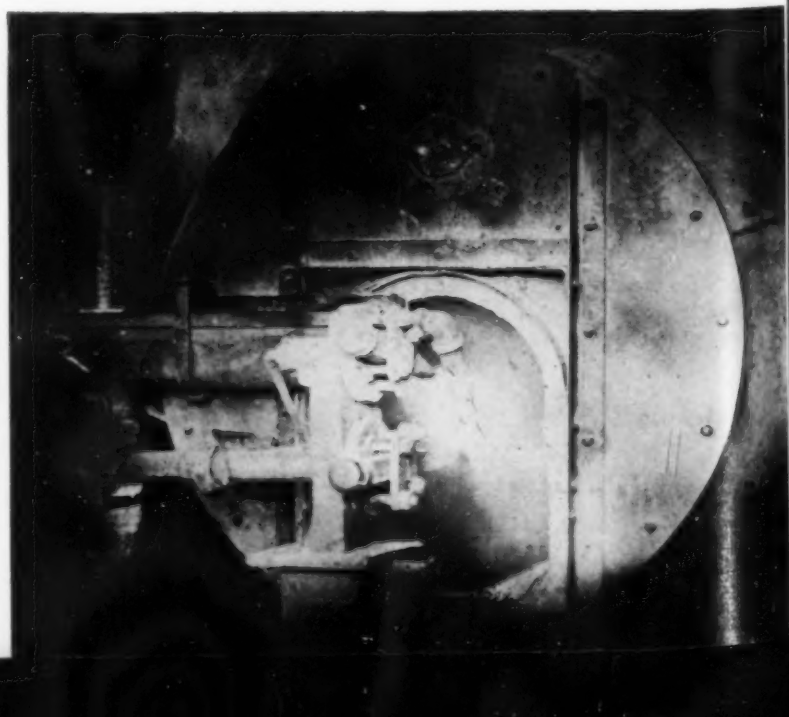
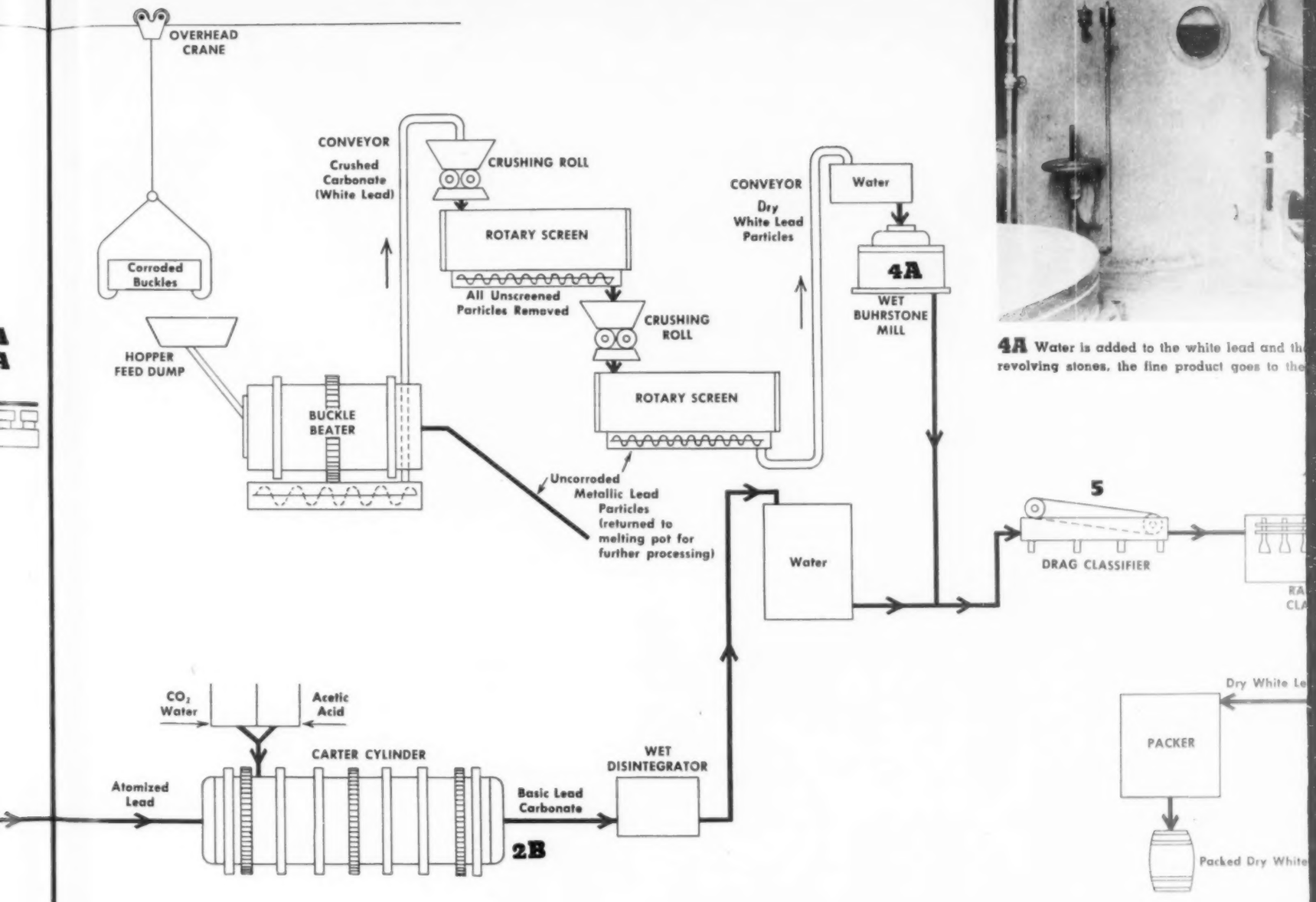
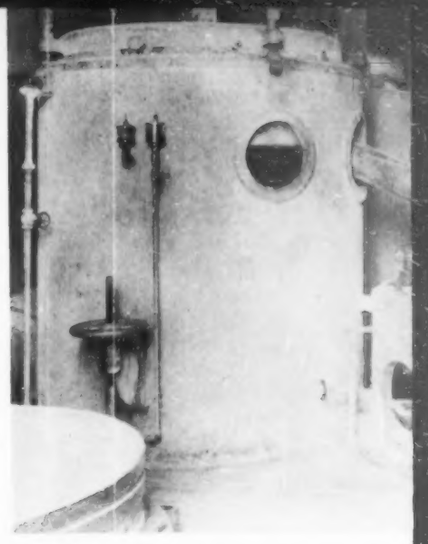




1B In the Carter process the lead is atomized to expedite corrosion. By this process white lead can be produced in 12 days

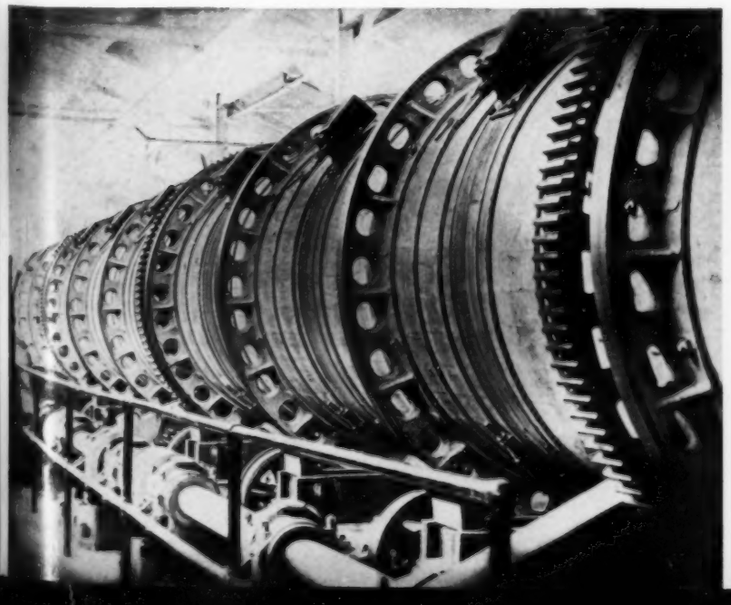




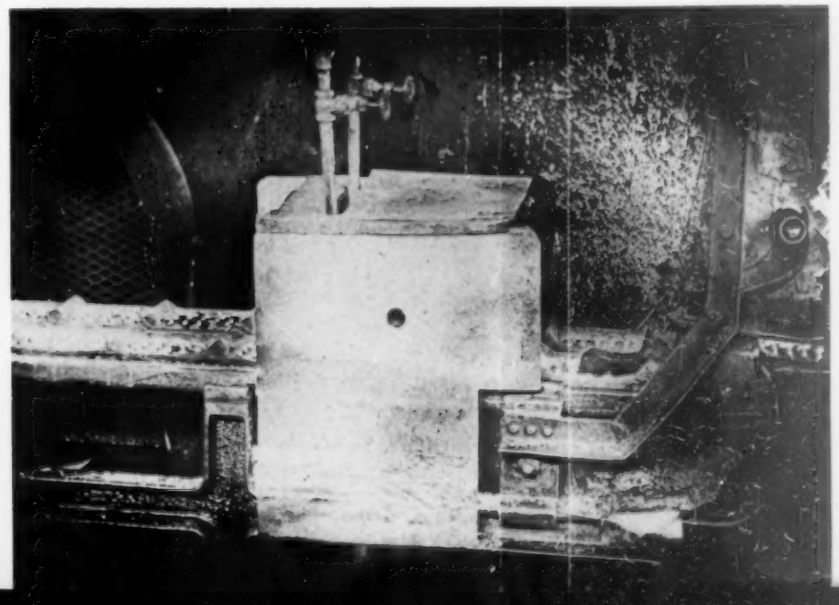


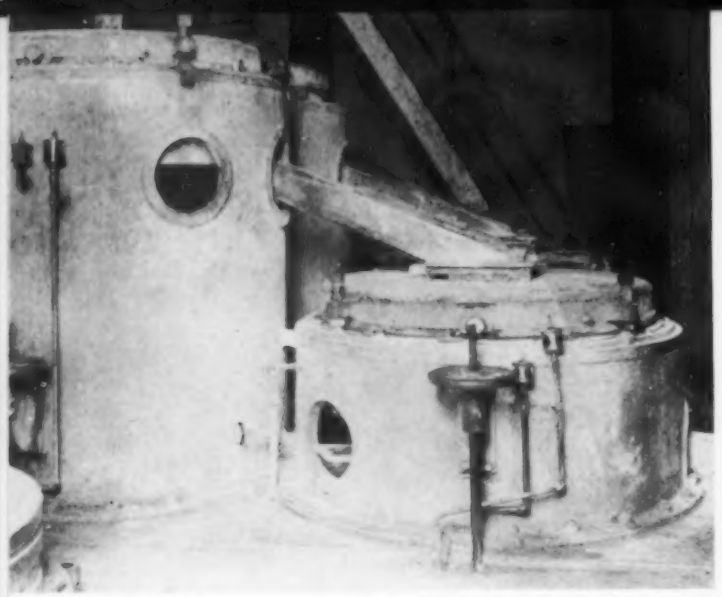
4A Water is added to the white lead and th revolving stones, the fine product goes to the

2B A current of flue gas rich in carbon dioxide passes through Carter cylinder in which dilute acetic acid has been sprayed on the lead

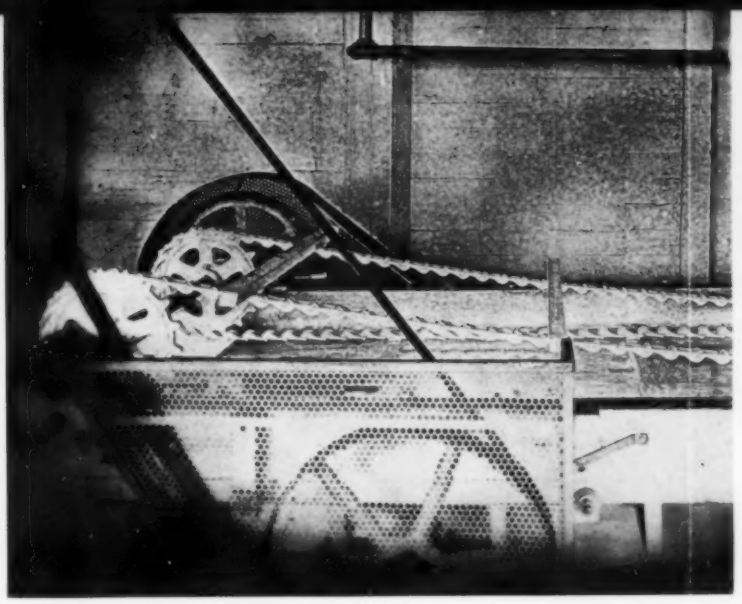


1A In the Dutch process pig lead is melted and cast into buckles which expose the greatest surface to acetic acid and CO_2. Casting avoids change in structure

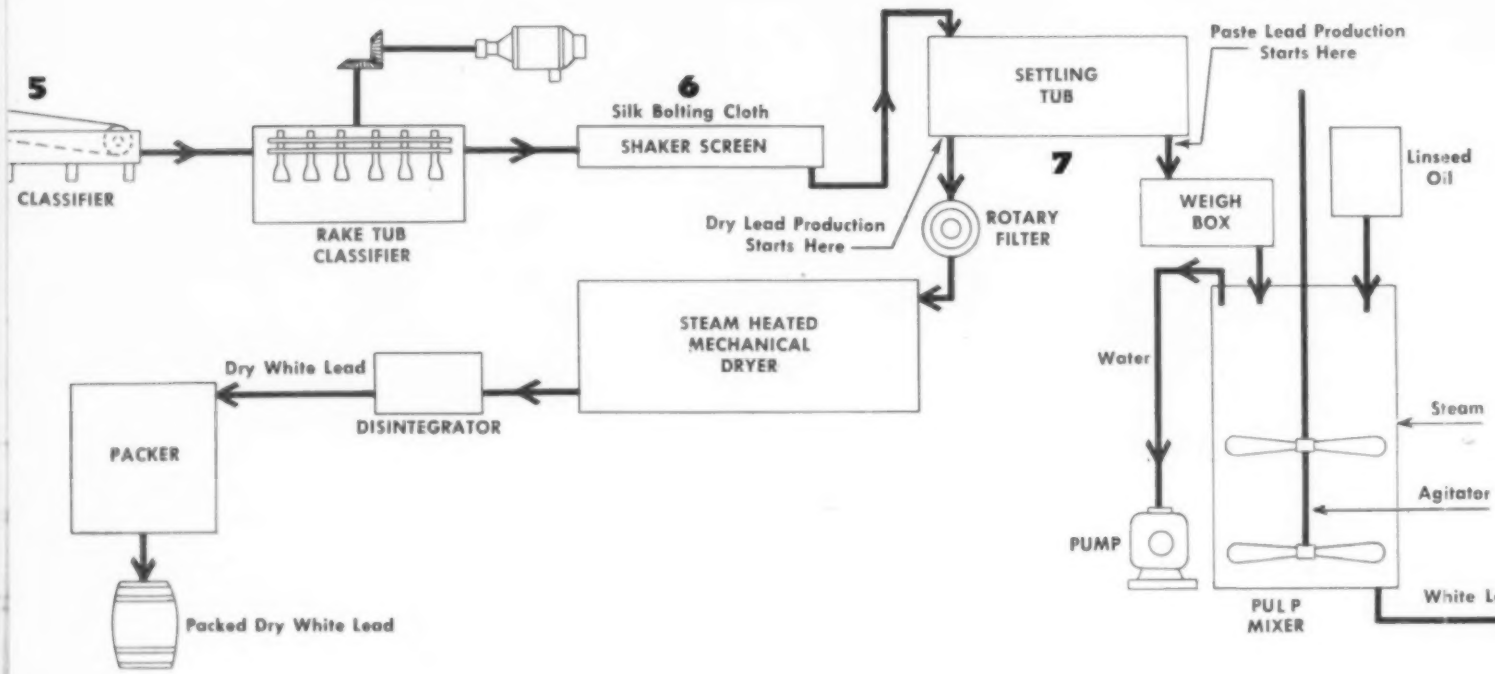




is added to the white lead and the mixture passed between heavy ones, the fine product goes to the "drag box"

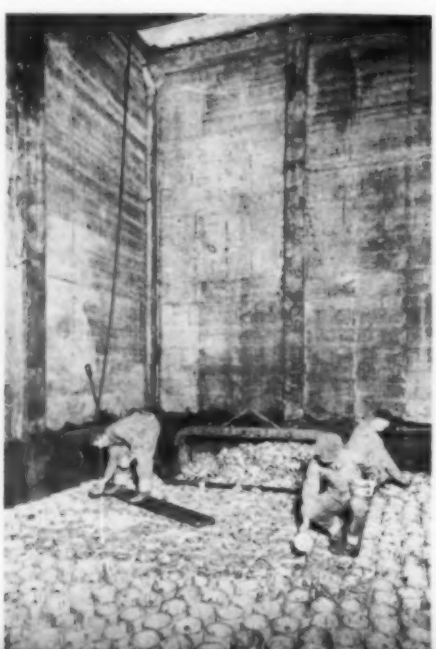


5 As the mixture of water and corroded lead flows the length of the drag box the small light particles flow over the lower end



uckles which expose the ge in structure

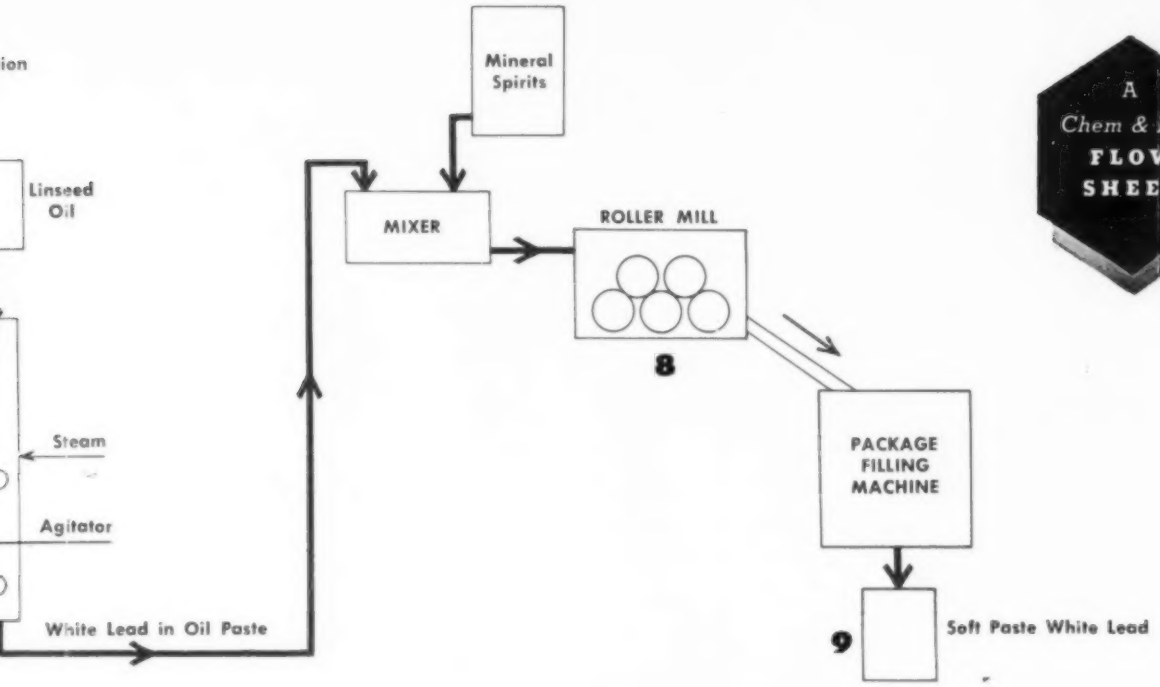
2A Corrosion takes place in earthenware pots containing acid



3A Ten layers of pots separated by tanbark are placed in these pits. In four months metal will be converted

6 From rake tubs, fine white lead floats onto a screen of silk bolting cloth. The screen is constantly agitated

7 White lead settles gradually in these tubs. Most of the water can be siphoned off.



A *Chem & Met* FLOW SHEET

8 The white lead and linseed oil mixture is ground by passing between a series of five heavy rolls revolving at a high rate of speed

9 Paste is accurately weighed in steel pails or kegs for shipment

Deep drawing made it light and strong enough to fly

This cylinder, a reservoir of hydraulic energy for aircraft use, is another example of the way in which the Hackney Deep-Drawing Process helps manufacturers strengthen and reduce the weight of parts simultaneously.

Hydraulic energy to feather propellers, operate landing gear, flaps, etc., requires accumulators which are light in weight, yet are strong enough to withstand high internal pressures.

Hackney Cylinders, Drums and Barrels This is but one of the many products developed by Hackney engineers to meet the exacting requirements of wartime service. Hackney production today is 100% for war. Hackney Cylinders, Drums and Barrels are being used by hundreds of war plants to solve their transportation and storage problems for vital chemicals. Hackney Containers are, therefore, helping to hasten the day when they will again be benefiting all industry.

And when that long-hoped-for day arrives, peacetime transportation and storage facilities will benefit by the things learned in this war. For instance, from the research and experience of Hackney, will come better, high quality containers for gases, liquids and solids.

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CRANE VALVES

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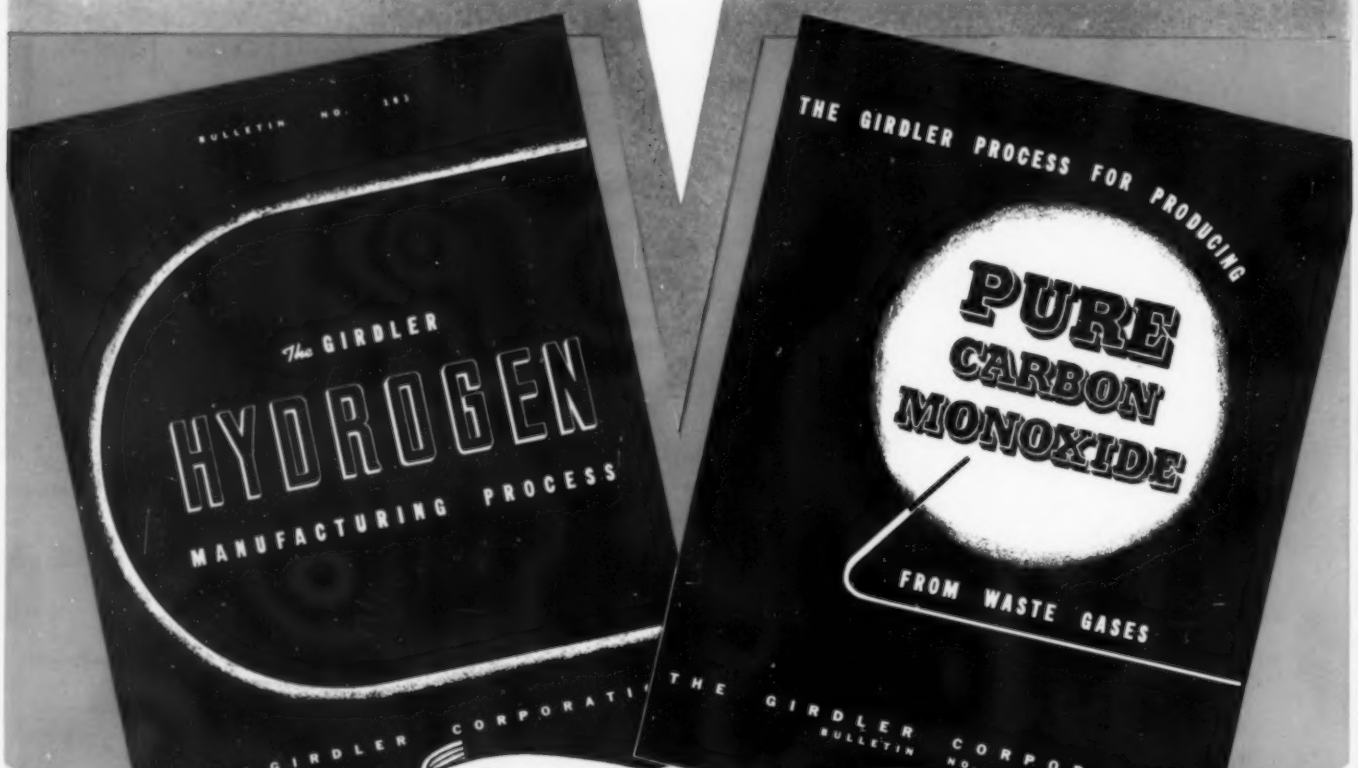

WITH the Girdler Hydrogen Process, hydrogen gas can be produced at *lower cost* than by any other known method. Operation of a Girdler plant is practically automatic. Hydrogen of excellent purity is produced in a continuous manner. Plants are available with capacities from 1,000 to 1,000,000 cubic feet per hour.

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Ask for free descriptive bulletin No. 103.

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HYDROGEN
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Write for illustrated bulletin No. 102, describing the Girdler CO Process.

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Chemical Engineering NEWS

ALIEN PATENTS RELEASED FOR WAR AND POST-WAR USE

More than 50,000 of all unexpired U. S. patents are under government control through the Alien Property Custodian. A definite policy has been fixed which makes use in this country practical for both war service and post-war purposes. This means that alien ownership of a patent is not to interfere with development by competent American enterprise.

Clear distinction must be made between enemy alien patents and those owned by aliens of occupied areas. Also, it is important to distinguish between other patents and those seized patents for which exclusive license to use was in force at the time of government seizure.

It is not the intention of APC to disturb the present normal use under exclusive licenses issued to American firms before seizure. The use of such patents may be extended to other firms, contrary to the exclusive license provisions, only where such supplemental use is necessary for war purposes.

Where patents are used under non-exclusive licenses, the present licensees can continue their use normally. Other licenses will be granted without royalty by the government under conditions most convenient for further development of alien patents. Only a nominal license application fee applies to a new applicant. The holder of an old non-exclusive license will, on request, be relicensed to use the alien patent without royalty, just as the new licensee would be authorized to do.

Where sums are payable to aliens under either exclusive or non-exclusive licenses, the moneys due are collectible by the Alien Property Custodian for proper subsequent disposition. It is not expected, however, that many non-exclusive royalty payments will be made under the circumstances which give options of change to licenses without royalty.

Licenses for use of patents owned by non-enemy aliens of occupied territory extend for the life of the patent. At the end of the emergency period terms may be negotiated between licensees and the non-enemy alien owners for the balance of the life of the patent. Alternative procedure is that a royalty for the post-war period may be agreed upon between the APC and the licensee.

Those wishing to make any arrangements, or merely to explore the possibilities of these patents, are urged to communicate with Alien Property Custodian offices. If information is wanted regarding available patents, communication should be addressed "Alien Property Custodian, Chicago, Illinois," from which office can be obtained indexes of the patents which are vested in that office. Matters of contracts and applications for licenses should be addressed to "Alien Property Custodian, Washington, D. C."

RAW MATERIALS BOARD MAKES FIRST ANNUAL REPORT

On January 26, 1942 the Combined Raw Materials Board was set up by decision of President Roosevelt and Prime Minister Churchill. It consists of two members, W. L. Batt for the United States and Sir Clive Baillieu for Great Britain. The board was charged with the responsibility for planning and integrating the raw materials program of the United States and Great Britain and for collaborating with the other United Nations to make certain that their raw materials resources were most effectively employed to assist the common cause.

Reviewing its operations in 1942, the board reported that very real progress has been made towards a planned and expeditious utilization of the combined raw materials resources in the prosecution of the war. The report shows that the board brought about an agreement among the governments concerned to regulate supply, distribution and use of the major strategic materials; cooperative purchasing and supply arrangements were worked out between the United States and Great Britain to prevent a scramble for the so-called secondary materials; and day by day discussions were held concerning current problems and information and evidence was assembled to form a basis for solution of such problems.

DOMESTIC PLANTS ACQUIRED FOR SHIPMENT ABROAD

Edward R. Stettinius, Jr., Lend-Lease Administrator, has announced that eight industrial plants operating in the United States had been acquired up to March 1 for lend-lease shipment abroad and that negotiations are pending for the acquisition of three additional plants. The total value of seven of the eight plants acquired is less than $12,000,000. The eighth plant was requisitioned with the consent of the owner and its value is now being determined according to the usual procedure in such cases. At the same time lend-lease has spent over half a billion dollars for production facilities completed in this country which are net additions to U. S. industrial capacity. These plants—many of them started in the spring and summer of 1941—have helped to step up our production of munitions and other war material. The amount expended for plants in the United States is 45 times the amount spent for the acquisition of operating U. S. plants for shipment out of the country.

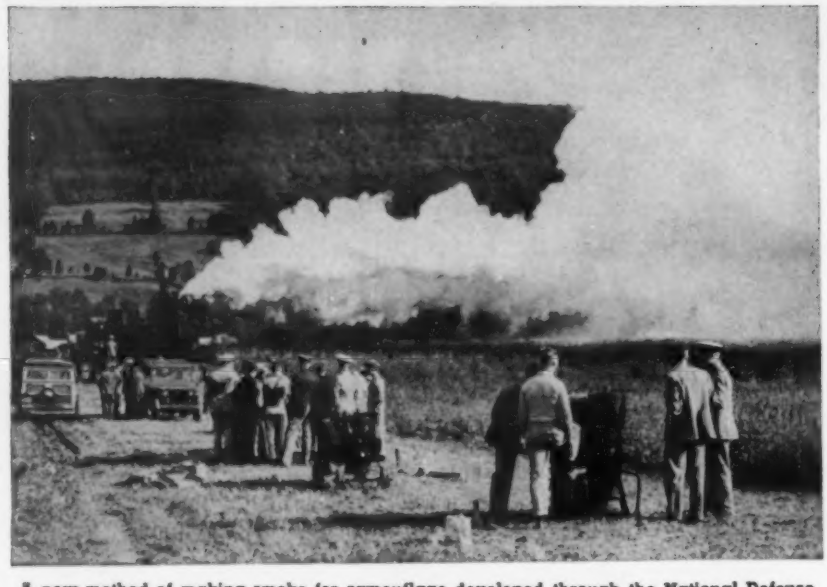
Three of the plants so far acquired are for Australia, three for Russia and two for India. Two of the plants for Australia were specifically requested by Gen. Douglas MacArthur. They will make cans for food supplied to our forces by Australia through lend-lease in reverse. All of the plants were acquired in order to fill important war production needs in areas near enough to combat zones to reduce the demands on shipping. None of the plants were acquired until the need had been examined by lend-lease representatives abroad and in this country and by the War Production Board in relation to needs of domestic consuming industries.

ST. JOSEPH LEAD CO. BUYS NEW JERSEY ZINC STOCK

Announcement was made at the beginning of the month that the St. Joseph Lead Co. had purchased 195,000 shares of capital stock of the New Jersey Zinc Co. This represented part of the holdings of the late Edgar Palmer who at the time of his death was president of the New Jersey Zinc Co. Clinton H. Crane, president of St. Joseph Lead Co. stated that the purchase represented less than a 10 percent interest in the zinc company and was made for investment out of his company's cash resources. The amount involved in the transaction was reported as $11,651,250 or at the rate of $59.75 a share.

M. E. CLARK HEADS PROGRAM SECTION OF WPB

Melvin E. Clark has been appointed chief of the newly formed program section of the Chemicals Division of the War Production Board. The new section comprises the following units: Statistics, Supply and Requirements, Audit, and Foreign Requirements. Its main functions will be to compile estimates of supply and demand for the output of the chemical industry and propose the most advantageous reconciliation thereof. Mr. Clark had been serving as chief of the Supply and Requirements unit.



A new method of making smoke for camouflage developed through the National Defense Research Council for the Chemical Warfare Service by Dr. Irving Langmuir and Vincent J. Schaefer of the General Electric Research Laboratory is shown being demonstrated in an upstate New York rural area. The smoke produced closely resembles natural clouds or fog and the method is a great deal more efficient than those previously used.

IMPORTANT SHIFTS MADE IN AGRICULTURE BUREAUS

In February a radical change in the make-up of the Bureau of Agricultural Chemistry and Engineering was made and the name of the organization was changed to Bureau of Agricultural and Industrial Chemistry. Two functions of the old Bureau were transferred to other agencies in the Department.

The Division of Protein and Nutrition Research under the leadership of Dr. D. Breese Jones was made a part of a newly established "Bureau of Human Nutrition and Home Economics." This Bureau will include also the old Bureau of Home Economics and will be under the leadership of Dr. Henry C. Sherman, formerly of Columbia University.

The Engineering Division of Agricultural Chemistry and Engineering was transferred to the Bureau of Plant Industry. This engineering unit was at one time an independent agency in the Department called Bureau of Agricultural Engineering.

The Bureau of Agricultural and Industrial Chemistry will shortly move all of its experimental work out of the Washington laboratories to Beltsville, Md.

COPPOCK SUCCEEDS MALIN IN CHEMICALS BRANCH OPA

Joseph D. Coppock has succeeded Patrick Murphy Malin as Chief of the Chemicals Branch, of the Office of Price Administration. Mr. Malin, who assumed that position last November, has resigned and will become associated with the Office of Foreign Relief and Rehabilitation Operations. Mr. Coppock was acting as special assistant to William L. Batt prior to joining OPA where he served as first assistant to Mr. Malin.

A change in personnel in the Chemical Section of the War Production Board also was announced with the transfer of Felix Stapleton from the statistical unit to the Lend-Lease Administration. Mr. Stapleton formerly was connected with the Tariff Commission and later with the Board of Economic Warfare.

VULCAN DETINNING TO COMPLETE PLANT AT PITTSBURGH

The War Production Board has authorized the Vulcan Detinning Co., of Sewaren, N. J., to resume construction on its Neville Island (Pittsburgh) plant which had been halted by a revocation order February 10, 1943.

FOR PRODUCTION EXCELLENCE

Among the companies which, in the past month, have been awarded the honorary Navy "E" and Joint Army and Navy "E" burgee for exceeding all production expectations in view of the facilities at their command, are included the chemical and explosives plants, the chemical process industries and the chemical engineering equipment concerns listed below. Other process and equipment plants will be mentioned in these columns as the awards are presented to the individual plants.

Absorbent Cotton Co. of America, Valley Park, Mo.
American Sterilizer Co., Erie, Pa.
Anacin Mfg. Co., Knoxville, Tenn.
E. B. Badger & Sons Co., West Virginia Ordnance Works, Point Pleasant, W. Va.
Baxter Laboratories, Inc., College Point, N. Y., and Glenview, Ill.
Beaumont Iron Works, Beaumont, Texas.
Brecon Loading Co., Coosa River Ordnance Plant, Talladega, Ala.
Caterpillar Tractor Co., East Peoria Plant, East Peoria, Ill.
Chicago Bridge & Iron Co., Eureka, Ill.
Cities Service Defense Corp., Maumelle Ordnance Plant, Little Rock, Ark.
Cochran Foil Co., Louisville, Ky.
Columbia Steel & Shafting Co., Carnegie, Pa.
Consolidated Chemical Industries, Inc., Baton Rouge, La.
Cook Paint & Varnish Co., Kansas City, Mo.
Cutler-Hammer, Inc., Twelfth Street Plant, Orchard Street Plant, Juneau Plant, Seventh Street Plant and foundry, Milwaukee, Wis.
Davis Emergency Equipment Co., Inc., Newark, N. J.
E. I. duPont de Nemours & Co., Pompton Works, Pompton Lakes, N. J., Wabash River Ordnance Works, Newport, Ind., Chickasaw Ordnance Works, Millington, Tenn., Alabama Ordnance Works, Sylacanga, Ala.
Edison General Electric Appliances, Inc., Chicago, Ill.
Exposition Cotton Mills Co., Atlanta, Ga.
Falchney Instrument Corp., Watertown, N. Y.
Fair Forest Finishing Co., Cleveland, S. C.
Foote Brothers Gear and Machine Corp., Precision Gear Division, Chicago, Ill.
General Electric Co., Appliance and Merchandise Department, Bridgeport, Conn.
B. F. Goodrich Co., Louisville, Ky. and Niagara Falls, N. Y.
Ingram-Richardson Mfg. Co., Beaver Falls, Pa.
Johns-Manville Corp., Manville, N. J.
The Kaydon Engineering Corp., Muskegon, Mich.
Kilby Steel Co., Anniston, Ala.
Lone Star Defense Corp., Lone Star Ordnance Plant, Texarkana, Texas.
Lucas Machine Tool Co., Cleveland, Ohio.
Magna Mfg. Co., Plants No. 1 and 2, Haskell, N. J.
Merck & Co., Falls of Skuylkill plant, Philadelphia, and Stonewall Plant, Elkton, Va.
Mohawk Carpet Mills, Inc., Amsterdam, N. Y.
Murray Ohio Mfg. Co., Cleveland, Ohio.
National Fireworks, Inc., Elkton, Md.
National Machinery Co., Tiffin, Ohio.
National Tool Co., Cleveland, Ohio.
Newnan Cotton Mills, Newnan, Ga.
Paterson Screen Co., Towanda, Pa.
Philadelphia Textile Finishers, Inc., Philadelphia, Pa.
Pittsburgh Steel Co., Allenport, Pa., and Monessen, Pa.
Porcelain Metals Corp., Louisville, Ky.
Queen City Steel Treating Co., Cincinnati, Ohio.
Reeves Bros., Inc., Greenville, S. C., and Woodruff, S. C.
Republic Steel Corp., Steel and Tubes Division, Cleveland, Ohio.
Saco Lowell Shops, Biddeford, Maine.
Seamless Rubber Co., New Haven, Conn.
Solar Mfg. Co., Avenue A Plant, West New York.
Spun Steel Corp., Canton, Ohio.
Standard Development Co., Esso Laboratories, Bayway, N. J.
Stanley Works, Tools Division, New Britain, Conn., and Tube and Stamping Division, Bridgeport, Conn.
St. Croix Garment Co., Stillwater, Minn.
The Stewart-Warner Corp., Indianapolis, Ind.
Trion Co., Trion, Ga.
Truscon Steel Co., Youngstown, Ohio.
Van Dorn Iron Works, Cleveland, Ohio.
Wagner Electric Corp., St. Louis, Mo.
Worthington Pump & Machinery Corp., Buffalo, N. Y.

The following firms have been added to the list of those who have received the "M" award given by the United States Maritime Commission in recognition of outstanding production achievement.

Buckeye Iron & Brass Works, Dayton, Ohio.
Columbia Steel Co., Pittsburg, Calif.
Dri-Steam Products Co., New York, N. Y.
Eastern Cold Storage Insulation Co., New York, N. Y.
Edward Valve & Mfg. Co., East Chicago, Ind.
Fort Pitt Steel Casting Co., McKeesport, Pa.
Jenkins Brothers, Bridgeport, Conn.
John Lucas & Co., Gibbsboro, N. J.
Maine Steel Products Co., South Portland, Maine.
Mercer Tube & Mfg. Co., Sharon, Pa.
National Tile and Marble Co., New York, N. Y.
Paxton-Mitchell Co., Omaha, Nebr.
Pitcairn Co., Barberton, Ohio.
Simplex Wire & Cable Co., Cambridge, Mass.
Socony Paint Products, New York, N. Y.
Summer Iron Works, Everett, Wash.
Turl Iron & Car Co., Inc., Newburgh, N. Y.
Union Steam Pump Co., Battle Creek, Mich.

WASHINGTON NEWS

ATTENTION of WPB is turning to the neglected job of keeping the "home front" in fighting trim. This is a significant change in tempo which carries prospects of better days ahead for chemical operations, as well as for other productive facilities. Maintenance of "home front" facilities in sound operating condition is now recognized at the top within WPB as perhaps the paramount problem of the next few months. This doesn't mean a widespread relaxing of the barriers; it doesn't mean an end of "making do," of substituting for less critical materials and equipment, etc. But it does mean that WPB realizes that a policy of continually piling up deferred maintenance is shortsighted and costly.

The effort will be to do for "home front" maintenance what has been done for war production—planned scheduling. During 1942, the emphasis was always on war production. Maintenance of productive plant was something that could wait. Now the need is becoming apparent for programing this minimum essential maintenance of productive plant on an equal footing with war production.

All this is one of the major underlying factors in the running fight between the military and civilian officials for control of the war administrative machinery which, in February, was climaxed in Nelson's dismissal of Ferdinand Eberstadt, who was replaced by J. A. Krug. As power director Krug has been scheduling utility expansion for over a year. The military, probably naturally enough, has little sympathy for preventive maintenance and the like when it takes materials which aren't available enough in enough supply for munitions programs.

Nelson, and Charles Wilson, the new production generalissimo in WPB, on the other hand, see the need for balancing minimum essential maintenance which will assure continued production against the temporary added output at the expense of neglecting machines, plants and men. For a period—roughly speaking, 1942—it was possible to let the "home front" sort of shift for itself and ride a little while on borrowed time, so to speak. Nelson feels that period is over. So does Wilson. WPB's authorization of the top priority rating of AA-1 for industrial maintenance, effective with the second quarter, is a step in the direction toward this new objective.

Butadiene Production

The decision to give top priority rating to only 50-odd percent of the synthetic rubber program at this time has resulted in deferment of work on several of the butadiene plants projected in the original WPB schedule. This doesn't mean the plants are to be abandoned, at least in all instances. Rather, it means that material and equipment ordered for these sites will be re-routed to those plants which are to be pushed to completion.

One of the first "stop work" orders applied to the refinery conversion at Texas City, Tex., a $1,500,000 project. Another halted conversion of a Standard Oil of Indiana refinery at Wood River, Ill., which was to have been finished by May 15. These actions indicated that most of that portion of the rubber program to be deferred will come out of the butadiene-from-petroleum, program, rather than from the alcohol-base plants.

That's partly political, but more directly attributable to the fact that one of the big reasons for trimming down the so-called Baruch rubber program is the need for greater high octane gasoline capacity. Thus, the petroleum industry's energies are being diverted somewhat from rubber and focused on the "must" program in that field.

National Service Controls

A showdown on the issue of "voluntary" vs. mandatory national service controls was developing early in March. Secretary of War Stimson's public endorsement of the Austin-Wadsworth national service bill and War Manpower Commissioner McNutt's declaration that the measure isn't necessary brought the matter into focus.

The Austin-Wadsworth measure would register all workers, make them subject to assignment by the Government to the jobs where they are considered to be most effective. McNutt previously has favored national service legislation but he opposes this measure and apparently is now opposing all mandatory procedures pending full trial of his executive authority.

On the "voluntary" manpower front were two significant actions. One was the listing of some 30-odd businesses and 29 occupations regardless of where they are found as "non-deferrable" in the future from the draft. This is a move to induce elevator operators, porters, bootblacks, etc., into war jobs—it hasn't proved very productive of home front manpower.

Second move was the President's proclamation of a 48-hour week, which McNutt applied to 32 labor-short areas and to metal and mineral mining and lumbering as industries. More areas were due to be added in March. In these areas, employers may not hire additional workers until they have reached a 48-hour workweek. Where going to 48 hours will neither release employes or increase necessary production, however, exemptions from the order are anticipated. Administration is in the hands of local WMC authorities. Outside the specified areas, employees should go to a 48-hour week only if it will increase production or make unnecessary additional hiring. In other words, despite the original fanfare over the order, the proclamation is intended to release workers or reduce additional hiring in the designated shortage areas, but only reduce additional hiring elsewhere.

Both of these actions ran into heavy opposition fire. WPB Civilian Supply Chief Joseph Weiner declared that the withdrawal of deferments from selected civilian occupations threatened to "short-change" employment for essential civilian production by sending workers needed to make shoes, clothes, etc., into war plants. Congress jumped on both actions as usurpation of legislation authority.

On the farm labor front, the situation is becoming steadily worse and Washington is now alarmed over the prospects of a serious food shortage due to lack of farm hands. The Army, however, is no longer carrying the whole blame; it is becoming apparent that more farm workers have gone into war plants than into the army—a point being used by those favoring mandatory service controls.

CMP Regulation No. 5

The advent of CMP Regulation No. 5 seemed to complicate the procedure for securing maintenance, repair and operating supplies for chemical operators. Actually such is not the case. If conditions in effect the first of March continue the applicable ratings for second quarter deliveries are higher than before Reg. 5 was issued while the requirements for rating applications and filing reports as set forth in P-89 remain in force.

Regulation No. 5 is the order under which all industry is to operate for MRO material delivered after March 31, 1943, both in the case of controlled materials obtained under the Controlled Materials Plan and in the case of materials and products obtained by preference ratings. Prior to the time Reg. 5 was issued chemical producers secured their repairs under P-89 or PRP, or P-100 if the company was not eligible for a serial number under P-89 or for assistance under PRP. Producers that have been operating under P-89 will continue to operate under P-89 as it is modified by Reg. 5. If the producer is operating under PRP and not under P-89 he may start at once to use P-89 as modified by Reg. 5 to secure material for maintenance and repair that is to be delivered April 1 or later.

This does not effect the procedure necessary to secure production materials. In the second quarter chemical producers operating under PRP will continue to use PRP to get their production materials even though they use P-89 to secure repairs and operating

supplies. Chemical producers under neither P-89 nor PRP will get priority assistance in securing their MRO under Regulation No. 5 as it stands.

Preference ratings in P-89 have been superceded by those in Reg. 5. The top rating, AA-1, may be applied by companies listed in Schedule 1 which includes the producers of acids, alcohols, alkalies, basic chemicals and intermediates, coal tar and coal tar derivatives, compressed and liquid gases, dyes colors and pigments, fats and oils. (Industrial only,) lacquers, organic and inorganic chemicals, paints, plastics and synthetic resins, soap, solvents, varnishes. Companies that are included in Schedule 2 may take the rating of AA-2X in place of the ratings in P-89.

Certification of purchase orders may be made as prescribed in CMP regulation 5 or 7. In either case it should bear the identification "P-89".

The quantity restrictions of Reg. 5 will govern for all MRO material purchased under P-89 after March 31. In general the amount is restricted to one-fourth the aggregate expenditures for the calendar year of 1942. The exception is for seasonal businesses which may use the corresponding quarter of 1942.

It will be seen that the ratings and quantity restrictions are those of Reg. 5 while for other regulations, including the definitions and the appeal clause, terms of P-89 govern. Appeals for industry reclassification may become vital to a producer at any time. An appeal under P-89 requires only the filing a letter, in triplicate, in which reference is made to the particular provision appealed from and the grounds of the appeal are fully stated.

The definitions under P-89 are broader and apply more directly to the problems of the chemical industry. The definition of maintenace illustrates this point. Regulation No. 5 states, "Maintenance" means the "minimum upkeep necessary to continue a facility in sound working condition," and "repair" means "the restoration of a facility to sound working condition when the same has been rendered unsafe or unfit for service by wear and tear, damage, failure of parts or the like: Provided, That neither maintenace nor repair shall include the improvement of any plant, facility or equipment, by replacing material which is still usable, with material of a better kind, quality or design."

Order P-89 says, "Maintenance" means the "minimum upkeep necessary to continue the working condition of the producers plant at its then current rate of production." This is followed by a paragraph which stated "Material for maintenace repair and operating supplies shall include: Material for the improvement of the producers plant through the replacement of material in the existing installation, but only when such equipment is beyond economical repair, or through minor additions of material in the existing installation to increase efficiency or production capacity."

It is hardly necessary to comment on the difference in these definitions and the importance to the chemical industry of having the definition of P-89 apply.

The Department of Labor has modified its interpretation of the double time wage payment requirements under Executive Order 9240. Double time is now required only where employees work seven consecutive days in the standard plant work-week—that is, the seven days which start with the same calendar day each week.

Effect of the interpretation is to allow continuance of the 7-day on and 1-day off and the 2-5-5-2 schedules without double time penalties. Double time wage payments made prior to February under the Department's previous interpretation calling for extra wages for the seventh consecutive day of work are not to be considered recoverable. Since the first of February, however, double time for a seventh consecutive day need be paid only where all seven days fall within the employer's regular work-week period.

End Use Information

Users of chemicals have been asked again to give suppliers end use information. The request, made in the form of a straight forward statement by the Chemical Division, should be considered seriously. It is evident that a situation paralleling that which occurred in Great Britain is developing in this country which makes it necessary to see that all chemicals are used for essential purposes. Both here and abroad experience has shown that without closed control many of the chemicals are diverted to non-war uses especially if they pass through a number of layers of suppliers and customers.

The Chemical Division believes that its forthright explanation of the situation will bring the required cooperation on the part of the industry. The policy of the Division to distribute chemicals by specific allocation rather than preference ratings and the requirements of certain of the chemical orders all make end use information necessary. The alternative is bureaucratic control which nobody wants.

WPB's Chemicals Division urged, early in March, all chemical plant operators in the country to file manning tables or interim replacement schedules with their state Selective Service Headquarters as soon as possible. The suggestion was advanced in a letter sent by the Division to more than 2000 plants. Stating that the unit is seriously concerned over the manpower requirements of the chemical industries, the letter points out that Selective Service has developed the manning table and replacement schedule procedures to enable war plant operators to indicate the order of importance of employes liable to military induction (*Chem & Met*, Dec. 1942, p. 122). Replacement schedules are simply skeletonized manning tables for use during a brief period while the more formal plan is being drafted and approved.

Approximately 50 tons of metallic manganese, recovered from low-grade ores with the government-patented electrolytic process developed by the Bureau of Mines at the Boulder City, Nev., pilot plant, has been turned over to the U. S. Treasury for lend-lease shipment and for use of the government's mints in producing nickel coins.

The supply, which has been increasing as the pilot plant operations reach a regular production basis, represents the output to date of the $2,000,000 test plant provided for by Congress as a war measure in 1940.

Boulder City manganese, which has been recovered at as high as 99.9 percent purity, is being used in nickel coins because experiments showed a need for a pure metal to provide the hardness, durability, electrical resistance, etc., required in coins. Use of a 9 percent manganese, 35 percent silver and 56 percent copper formula for the nation's 5-cent pieces was decided upon as a means for saving copper and nickel—both of which are more scarce than manganese. The old formula was 75 percent copper and 25 percent nickel.

Dr. Mendenhall Retired

Retirement of Walter C. Mendenhall, Director of the U. S. Geological Survey, after having served over 48 years as a scientist in that organization, was announced February 27. Dr. Mendenhall entered the service in 1892 and became Director of USGS in 1931. He was 72 when he retired having twice been exempted from compulsory retirement after having reached his seventieth birthday.

Until a new director is appointed, Dr. Julian Sears, Administrative Geologist, will be the acting Director. Dr. Sears, a geologist and scientist is a career man who has been connected with USGS for 30 years. He has been Acting Director and Administrative Assistant for some years past but this fact cannot be taken as evidence that he will be chosen for the office of director. It is generally agreed in Washington that an economic geologist is required for the position left vacant by Dr. Mendenhall.

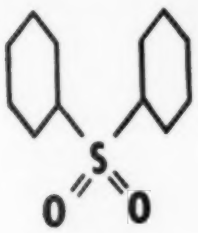
Manpower seems to be the biggest problem confronting the fluorspar producers. To deal with the problem USES has set up local offices in southern Illinois and western Kentucky to help recruit additional labor. Also working on the problem is a sub-committee of the Industry Advisory Committee. This group has been meeting at frequent intervals.

Senator Kilgore has reintroduced his bill to mobilize the scientific and technical resources of the nation and to establish an Office of Scientific and Technical Mobilization replacing the bill for the same purpose that died with the last secession of Congress. The present version is slightly more drastic than the last, tending as it does to socialize scientific and technical work that has heretofore been considered strictly in the field of private enterprise.

Washington does not believe that this bill will pass but at the same time feels that it will have to be carefully watched.

New Product Report

DIPHENYL SULFONE



DIPHENYL SULFONE, sometimes called sulfobenzid, was first described in 1834 by Mitscherlich, who obtained it as a by-product in the sulfonation of benzene with oleum or sulfur trioxide.

It can be chlorinated and sulfonated, although under certain conditions these and other reactions result in splitting the molecule at the sulfone link. Heating with sulfur or selenium produces diphenyl sulfide or diphenyl selenide.

This interesting new material is now in production on a laboratory scale and is potentially available in larger quantities. For experimental samples simply fill in and mail the coupon below. MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston, Massachusetts, and St. Louis, Missouri.

PROPERTIES

APPEARANCE:

White needle-like or flake-like crystals.

MELTING POINT:

129°C.

BOILING POINTS:

380°C. at 760 mm.
230°C. at 15 mm.

SOLUBILITY:

Slightly soluble in hot water. Soluble in most of the usual organic solvents.

SUGGESTED USES:

The characteristics of Diphenyl Sulfone suggest use as an intermediate in organic syntheses or in the preparation of diphenyl sulfides, selenides and their derivatives.

AVAILABILITY:

Diphenyl Sulfone is now available in laboratory quantities in the following grades:

Technical: Grayish white powder, m. p. 120-125°C.

Pure: White crystals, m. p. 127-129°C.

It is potentially available in larger quantities.

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INTERPRETING WASHINGTON

EDITOR'S NOTE: *Copies of the orders, rules and regulations covered in this installment may be obtained by writing to the appropriate federal agency, citing the order number or release date.*

FANS AND BLOWERS

Deliveries of fans and blowers are now controlled by a separate Limitation Order, L-280. They were previously covered under Order L-123 as general industrial equipment. The control extends to any new device or machine which moves, compresses, or exhausts air or other gases by centrifugal, rotary or axial means. A few types of fans exempt from this order are (1) wall type propeller fans having a blade diameter of less than 17 inches, (2) ceiling, air circulator, desk, wall bracket, and portable window fans, and pedestal type fans of a portable nature, (3) blowers incorporated in other machinery, (4) propeller fans for internal combustion engines, and (5) critical turbo-blowers as defined by Limitation Order L-163, as amended.

As of March 1, no manufacturer or dealer may accept a purchase order for a fan or blower, unless the order bears a preference rating of AA-5 or higher, or else is specifically approved by the Director General for Operations; after March 31, no deliveries shall be made except on rated or specifically approved purchase orders. Authorization to fill unrated orders now on the books may be obtained by filing a report thereof in duplicate on form PD-795, together with a statement of the percentage of completion of each such order. The restrictions on deliveries do not apply to any order for repair parts totaling not more than $500 for any single fan or blower, or 50 percent of the original sales price of the item to be repaired, whichever is less in any particular case. In the case of an actual breakdown or suspension of operation, this Order places no limitation on the amount of essential repair and maintenance parts which may be delivered.

Each manufacturer of fans and blowers must file on or before the 18th day of each month a report (Forms PD-795 and 796) showing his delivery schedule for fans and blowers for the next two months.

WOODEN AND FIBER SHIPPING CONTAINERS

Preference Rating Order P-140, issued February 24, assigns Preference Ratings for the purchase of wood and fiber shipping containers for military and essential civilian products. The orders covers any container which is made in whole or in part from wood or corrugated or solid fiber, and which is used as an outer container for the delivery or shipment of materials. It also covers any part which is cut to size for a shipping container. The order contains five lists of various products and the ratings assigned to each group as follows:

AA-1 rating is assigned to containers for various combat end products complete for tactical operations.

AA-2X rating is assigned for certain other military items, for Lend-Lease products, for export shipment and for food set aside for purchase by government agencies under government orders.

AA-3 rating is assigned for various products including fresh foods, chemicals other than those assigned AA-4, industrial machinery including electrical equipment, etc.

AA-4 rating is assigned for certain chemicals (mainly sulphates, phosphates and carbonates), boiler equipment, petroleum products, pipe and pipe fittings, pumps and pumping equipment, etc.

AA-5 rating is assigned for other miscellaneous products including paper and pulp, leather, paints and flat glass.

Ratings assigned under this Order will be the only ratings (other than AAA ratings) usable for the purchase of wood and fiber shipping containers regardless of any other Order or certificate. They may be applied to any existing unfilled purchase order for shipping containers or parts, placed prior to February 24. Existing ratings, inconsistent with Order P-140, remain valid for such purchase orders only if the container or cut-to-size parts were delivered or in transit before March 11, 1943.

If a shipper experiences difficulty in securing containers for products not listed in the Order, he may apply for a rating on Form PD-802. PRP units which are eligible to use the ratings assigned by this Order are not restricted by any contrary provision of any priority regulation applicable to CMP.

CONTAINERBOARD

Beginning with the month of April, containerboard mills are directed to set aside 25 percent of their monthly kraft and jute containerboard production for allocation by WPB to container manufacturers making V-boxes, according to Conservation Order M-290, issued March 2. V-boxes are a new type of container developed to replace wood for certain military and Lend-Lease shipments.

METAL CANS

Restrictions on the use of metal cans for certain products have been revised by amendment of Conservation Order M-81, issued February 20. Under the amendment, a paint manufacturer may use one-gallon fiber-bodied containers with black plate ends, but one-half of the ends of such cans must be made from black plate or black plate rejects frozen in the hands of can manufacturers or their suppliers on Dec. 9. For the first time a paint manufacturer may use a one-quart can with a fiber body and end. The rings only may be made of new metal, and the plugs must be made only from waste black plate recovered in the manufacture of ends for one-gallon fiber-bodied paint cans. The amount of metal a packer may use in fiber-bodied paint containers is 35 percent of the area of plate he used in his 1942 production. A manufacturer may produce 50 percent of his 1942 production of five-gallon cans for packaging cottonseed oil, soybean oil, peanut oil and other liquid edible oils. Other products affected by this amendment include paste soap, shoe-polish, ointment and salve, and certain food products.

FEED WATER HEATERS

Schedule III of General Limitation Order L-154 which established control over certain metals in the manufacture of feed-water heaters was revoked on March 1, as control under Order L-172 is adequate.

INDUSTRIAL EQUIPMENT REPAIRS

Amendment to Order L-123, issued Feb. 27, provides that purchase orders not exceeding $1,000 in value for repair parts for any single piece of general industrial equipment, or in any amount for parts needed to repair actual breakdowns, no longer need to be accompanied by certificates showing that they are exempted from the restrictions of the Order. "General industrial equipment" is defined in the Order.

GENERAL SCHEDULING ORDER

M-293, issued by WPB on Feb. 26, formalizes existing scheduling practices and provides a regular procedure for future contingencies. The Order provides specific regulations which cover the manufacture and distribution of critical components such as valves, pumps, fittings and bearings, the production of which constitutes the No. 1 bottleneck. Purchase orders for the most critical of these items may be placed only after receiving specific authorization from WPB.

NEW CONSTRUCTION

A recent amendment to Conservation Order L-41, effective Feb. 19, revises the definition of what constitutes maintenance and repair of a building. If a single job is partly maintenance and repair, and partly new construction, the whole project will be considered new construction and therefore subject to

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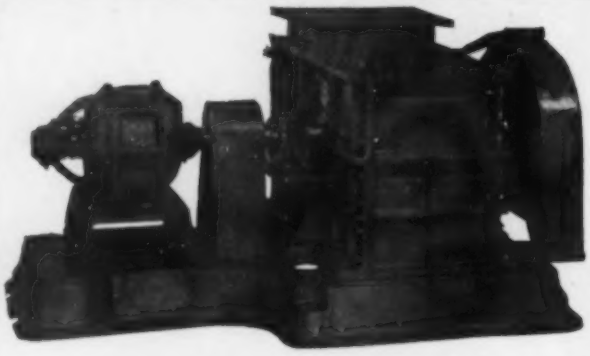

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the $5000 limit of the Order. The cost of production machinery or equipment to be used directly in manufacture should not be included in this total. Provision is made for emergency work on any damaged structure for the protection of the structure and the public. This permits the shoring up of walls of a damaged building.

PORTLAND CEMENT

General Limitation Order L-179 has been amended to remove the clause which prohibits manufacturers of Portland Cement from assigning storage bins for exclusive use by individual customers. Removal of the ban on assignment of storage space to customers means also that certain restrictions previously applied to the testing of Portland Cement will no longer be applicable or necessary. Specifications for testing Portland Cement remain the same, but the amended order no longer requires that such tests be made exclusively by the National Bureau of Standards or by a laboratory designated by that Bureau. The provision of the order which reduced to three the number and types of cement that may be manufactured remains unchanged.

ANHYDROUS ALUMINUM CHLORIDE

The complete allocation of aluminum chloride (anhydrous) is covered by General Preference Order M-287, issued February 20. Requests for delivery in any calendar month, whether for consumption or resale, must be filed on Form PD-600 on or before the 15th day of the preceding month beginning in March. An exception to this Order provides that delivery of one 10-lb. lot may be made in any calendar month without authorization, and up to 50 lb. may be delivered if a purchaser will certify on his purchase order that he will not receive more than 50 lb. total for that month. However, all authorized purchase orders must take precedence, and in any case not more than 1 percent of the producers deliveries in any one month shall be made up of these small orders. Suppliers seeking authorization to make delivery in any calendar month must file application form PD-601 on or before the 20th day of the preceding month.

CATTLE HIDE LEATHER

The shortage of leather has resulted in the issuance of Conservation Order M-273 designed to conserve leather and direct its distribution into military and essential civilian products. "Cattle Hide" leather, which is covered by the Order, includes the skin or hide of bulls, steers, cows and buffaloes, including calf kip skin.

In addition to placing restrictions on the processing of leather, the Order prohibits the use of leather in any product not listed in the Order. The list includes such products as footwear, transmission belts, mechanical leather products, and harness, horsecollars and

llery for police, farm and industrial use.

Manufacture of any product not mentioned on this list is confined to lightweight leather or other leather specifically exempt, or types other than cattle hide. However, leather purchased before February 17 may be used for any purpose if it is delivered prior to April 1, and completely fabricated before June 1. Leathers which are specifically exempt from the restrictions are (1) vegetable tanned leather weighing less than 3½ ounces, other than calf or kip, (2) upholstery leather buffings, (3) leather scrap and (4) leather not suitable for military or essential civilian products as specifically authorized by the Director General for Operations.

Tanners must file monthly reports of their operations, using Form PD-770 for upper leather, Form PD-778 for calf and kip leather and Form PD-772 for harness, skirting, etc.

SILICA GEL

General Preference Order M-219 which was issued last October to place the entire supply of silica gel under allocation has been revoked. Allocation requests have been granted in full for the past month, and it appears that production capacity is adequate for all needs. The principal use of silica gel is for the protection of ordnance items against moisture.

CAPRYL ALCOHOL

Allocation Order M-167 covering Capryl alcohol was amended on Feb. 6. Applicants for allocation must now file Form PD-600 on or before the 20th day of the month preceding the month for which authorization for delivery or use is sought, and producers or distributors must file Form PD-601 on or before the 25th day of the month preceding the month for which authorization to make delivery is sought.

PHTHALATE PLASTICIZERS

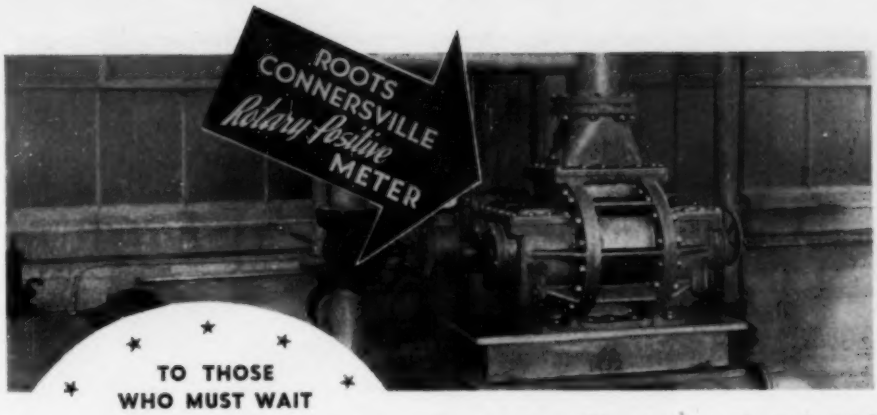
Allocation Order M-203 covering Phthalate plasticizers was likewise amended on Feb. 6, providing for the use of Form PD-600 and PD-601. Form PD-600 must be filed on or before the 15th day of each month, and Form PD-601 on or before the 22nd day of each month. Suppliers who are customers must list their own names on both forms.

NITROCELLULOSE

Washed film scrap and other nitrocellulose scrap were placed under allocation by General Purpose Order M-196, as amended, effective Feb. 10.

YELLOW POPLAR

Yellow poplar logs, lumber and veneers of grades suitable for use in military and naval airplanes have been placed under allocation through issuance of General Conservation Order M-279.



TO THOSE WHO MUST WAIT

Even though priorities may prevent your obtaining new equipment at present—there's no priority on working out plans and problems now for post-Victory operation. Our representatives will gladly cooperate. Write for latest bulletin.

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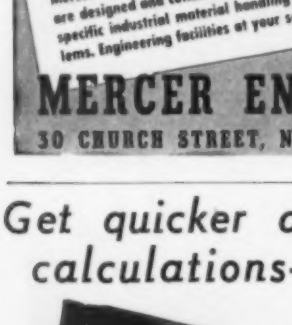

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SEEDLAC

Seedlac, crude form of lac, was placed under allocation through issuance of Allocation Order M-106, replacing Conservation Order M-106. Form PD-617, revised, should be used for application for authorization and inventory reports should be made out on revised form PD-334.

REMELT ZINC

Additions to Conservation Order M-11 place remelt zinc under the same control as the six higher grades, limit deliveries by dealers to orders bearing preference ratings of AA-5 or higher, and regulate use of scrap.

LEATHER TANNERS

Sole tanners and converters are required to continue to set aside 25 percent of their manufacturers' type sole leather bend production for repair of civilian shoes during March and subsequent months until further notice.

APPEALS

The War Production Board released on February 17, the following list of Orders which may be appealed only through WPB Field Offices. This list is contained in the amendment of Schedule A of Priorities Regulation No. 16.

ORDERS

L-18-b	L-59-a	L-152 (PD-417)
L-18-c	L-59-b	L-157 (Letter)
L-21	L-62	L-161
L-21-a	L-64	L-165 (Letter)
L-22 (Letter)	L-64-a	L-173 (Letter)
L-23 (PD 203)	L-73	L-179 (Letter)
L-23-a	L-74 (Letter)	L-185 (Letter)
L-23-b	L-77	L-187
L-23-c	L-79 (Letter)	L-199 (Letter)
L-27 (Letter)	L-80	L-205 (Letter)
L-27-a	L-81	L-218
L-29	L-92	L-225
L-30-a	L-93	L-229 (Letter)
L-30-b	L-98	L-236 (Letter)
L-30-c	L-104	M-11-b
L-30-d	L-135	M-83 (Letter)
L-33	L-136	M-122 (Letter)
L-36	L-142 (Letter)	M-126
L-42 (Letter)	L-150 (Letter)	M-177 (Letter)
L-49	L-150-a (Letter)	M-208 (Letter)
L-59	L-150-b (Letter)	M-209 (Letter)
		M-248 (Letter)

Appeals for relief from the restrictions imposed by the above Orders must be filed with the appropriate WPB Field Office on Form PD-500, except where otherwise indicated. Appeals from orders not listed should be mailed directly to WPB in Washington. If no particular form is specified, the appeal should be made by letter, in triplicate, stating in detail the grounds for the appeal.

OPA RULINGS

Packaging differentials may be added to the maximum price of ferrochromium when it is packed for shipment in carload lots, or for shipment to U. S. Government Procurement Agencies in special containers, according to Amendment No. 107 to Supplementary Regulation No. 14 of the GMPR. The charge permitted to cover the cost of packing carload lots in barrels or drums is $7 per gross ton. To this base charge may be added $3 per gross ton for shipment to government agencies if packed to the

buying agency's specification in 50-gal. barrels or drums; or $6 per gross ton on such shipments if packed to the buyer's specifications in containers of less than 50-gal. capacity. This additional charge is in lieu of the special packing expenses permitted to be added by Supplementary Order No. 34. "Ferrochromium" means any alloy principally of iron and chromium containing not more than 75 percent or less than 55 percent chromium.

MPR No. 316 (replacing GMPR control) was issued on Feb. 6 to simplify price controls over coated and bonded abrasive products. These include sandpaper and abrasive-coated cloth, and grinding wheels, segments, sticks, sharpening stones, diamond bonded abrasive products, etc. The regulation continues the use of March, 1942 prices as the price base and insures the continuation of discounts on sales to the United States or any of its agencies, or to the governments of the United Nations or their agencies, and provides for pricing new products.

MPR No. 323, issued Feb. 15, clarifies and simplifies the price ceiling which had previously been established for asphalt and asphalt products under RPS 88. In general, prices are kept at the level prevailing from Aug. 1 to Nov. 1, 1941. F.O.B. refinery price ceilings are specified for 27 refinery areas. A differential ranging from $2 to $4, depending on the refinery location, is added to the bulk price of the material to be packaged, covering filling and handling costs. Brokerage or commissions which increase the cost to the consumers over the prices listed in the schedule are not allowed. However, a differential is allowed a dealer who performs an essential marketing function.

In order to alleviate the shortage of soybean oil by encouraging farmers to move soy beans promptly, OPA set a $1.66 per bushel ceiling on top grades through issuance of MPR-331 on Feb. 22, effective Feb. 27.

The demand for industrial waxes used for waterproofing, coating artillery shells, etc. has caused importers to supplement their supply from new sources. Consequently, MPR-264 was amended on Feb. 26 to cover imports being received from Haiti, Iran, Portugal and other countries.

The OPA and the Canadian Wartime Prices and Trade Board announced on Feb. 27 that American and Canadian producers of standard newsprint paper may increase their price by $4.00 per ton. The increase, first in five years, became effective March 1 and makes the new "port" ceiling price $54.00 per ton, with zone prices adjusted accordingly.

The OPA has issued revised MPR-230, effective Feb. 9, covering revisions to price regulations for reusable iron and steel pipe.

A simple method for determining maximum prices for agricultural insecticides and fungicides, whose formulas have been changed by wartime shortages, was established for manufacturers on Feb. 9 by Order No. 260 under General Maximum Price Regulations, effective Feb. 3.

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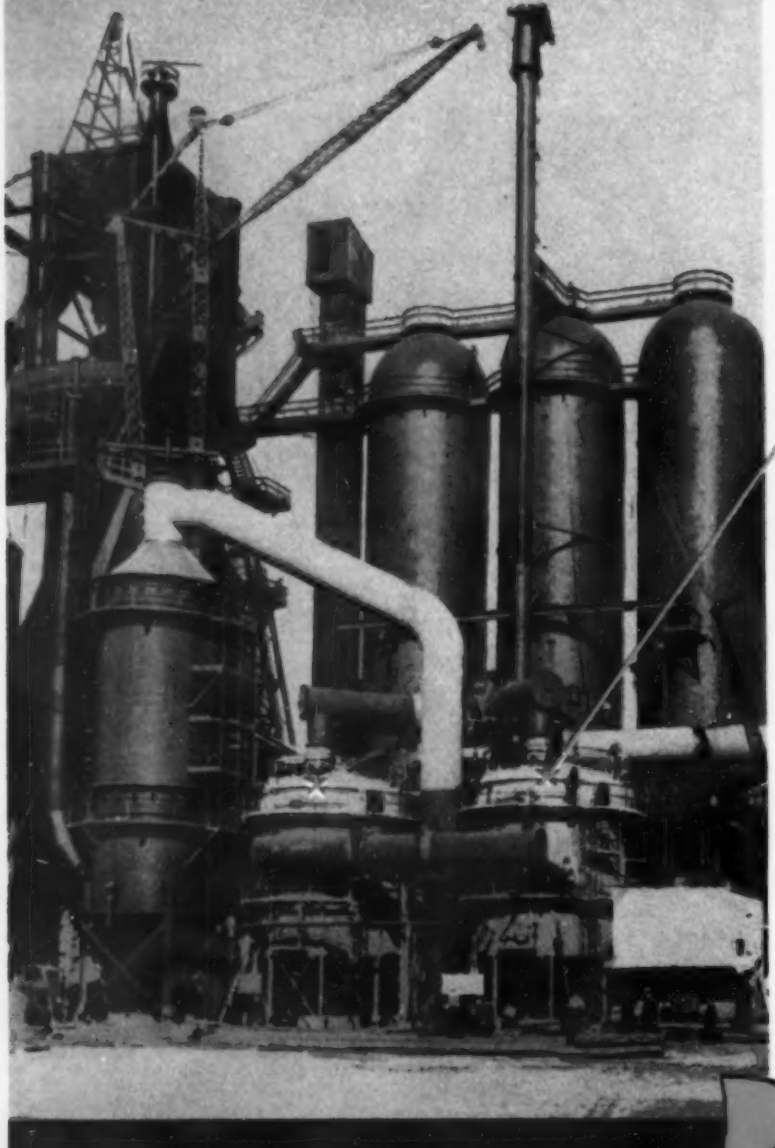

When the chips are down and there's a heavy-duty recovery job to do—*and do right*—invariably the choice is COTTRELLS!

In building the giant new $83,000,000 Kaiser steel plant at Fontana, California, the designers took no chances. Normally a two-to-three year job, this plant was rushed to completion in 8 *months* to fill vital war needs on the Pacific Coast. And because the need was urgent, every item of equipment selected for installation was the best obtainable . . . *equipment conclusively proven superior through years of heavy-duty industrial service!*

It is only logical, therefore, that COTTRELL Electrical Precipitators were chosen to handle the gas cleaning problems on the blast furnace and in the by-product coke plant . . . for COTTRELLS are recognized throughout the world as the most efficient method yet developed for recovering *any* kind of solid or liquid suspensions from gases, *hot or cold!*

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* The two COTTRELL Precipitators shown above being installed at Kaiser's Fontana steel plant will (1) clean the blast furnace gases for further use . . . (2) recover dust for the sintering plant where it will be used as a binder . . . and (3) provide a final exhaust, clean and free of nuisance. COTTRELLS remove not only suspended solids, but also water vapor, providing what is known as a "dry" gas.

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NEW PRODUCTS AND MATERIALS

LUMINOUS PLASTIC SHEETING

After the new FPC luminous plastic sheeting recently developed by Fluorescent Pigments Corp., New York, N. Y., is excited by a fotoflood lamp, an ultraviolet lamp or daylight for about 20 seconds, or by an ordinary 100-watt lamp for a minute, it promises to glow for 24 hours if the surrounding temperature is 70 deg. F. If colder, the afterglow is less bright, but lasts longer. If hotter, it is brighter for a shorter time. The afterglow is heightened by infrared or heat rays quenched almost instantly by red light but easily re-excited as in the first instance.

The sheeting (which will also come in the form of tape) is made by hot-pressing a prefabricated phosphorescent pigment film between two layers of polystyrene plastic film. Since such plastic is notably resistant to moisture temperature change and chemical reaction, the composite material will lend itself to civilian safety. The afterglow of the material is blue-green, a color to which the dark-adapted eye is particularly sensitive, but which does not destroy its dark adaptation. This feature plus its ability to be extinguished by red light and re-excited quickly are of particular importance to night flyers and to many applications.

ION EXCHANGERS FOR INDUSTRIAL PROCESSES

Development of acid-regenerated cation exchangers and of suitable anion exchangers has widened the fields in which ion exchange materials may be used. Chemical engineers can now apply these materials and equipment to advantage in a great variety of industrial processes, according to an announcement of the Permutit Co., New York, N. Y. Operations of cation exchange, anion exchange, acid removal and demineralization can be visualized as applying to a multitude of industrial processes where water is the solvent medium in whole or in part. Acid removal has even been demonstrated to be applicable to some processes where no water is present in the liquid phase. In general, ion exchange is applicable to the following types of processes: (1) recovery of valuable electrolytes which are present in dilute solutions; (2) removal of small quantities of ionic impurities from low cost products; (3) separation or fractionation of (a) electrolytes from non-electrolytes, (b) strong electrolytes from weak electrolytes, (c) multi-valent ions from ions having a different valence, (d) monoatomic ions of low atomic number from those of high atomic number; (4) catalysis; (5) scrubbing gases.

The field of ion exchange in the process industries is relatively new and offers much promise. To make a successful investigation of any particular problem, it is necessary to appreciate and utilize the unusual advantages which these materials offer. Use of a good ion exchanger is not sufficient. Proper operating technique and the design of equipment are perhaps even more important.

CHOLESTEROL AND STEROL PRODUCTS

Special cholesterol and sterol products designated as Amerchol S have been developed for industrial use by American Cholesterol Products, Inc., of Milltown, N. J. These new agents are effective stabilizers, emulsifiers and dispersing agents for drugs, cosmetics, textiles, dyes, inks and in other industries. Only very low concentrations are necessary to obtain the desired effect. Amerchol S is a pale, straw-colored, odorless, semi-solid, non-volatile oil which will not thicken or dry out. It is completely soluble in animal, vegetable and mineral oils, and is readily dispersed in soapy water. The activity of this material is due to its high content of cholesterol and other free sterols. These agents have long been recognized as important surface-active materials. However, relative scarcity, high costs and technical difficulties have prevented their production and use. The development of new methods for large scale production has been accomplished. Physical and chemical stability is a feature of Amerchol S because of the chemical inertness of its components. It is free of acids, alkalis, esters, soaps, amines, glycols, and resins. It is completely unsaponifiable, and will not undergo polymerization. It is unaffected by acids, alkalis, electrolytes and oxidizing agents. None of its components have a tendency to develop rancidity, color or odor on standing.

RESIN EMULSION WATER PAINT

Within the last few years water-thinned paints have enjoyed a large increase in popularity. Pittsburgh Plate Glass Co., has just introduced an entirely new water paint of the resin emulsion type, called Techide. It should not be confused with casein water paints because it is made from synthetic resins, oils and pigments. This flat wall paint is easy to apply on wallpaper, old painted surfaces, plaster, wallboard, cement, brick and casein-painted surfaces. During application and for a few days after a faint odor is noticeable although it is not objectionable. Because Techide dries to a perfect flat matte finish, defects in workmanship are not conspicuous. When a two-coat job on fresh smooth plaster walls is desired, a wall primer or size will assure perfect results. No turpentine or other solvents are needed for painting most surfaces. The proper reduction is one-half gallon of water to one gallon of Techide. It dries in one hour and if a second coat is desired it can be applied in three hours. The room can be occupied the same day. The washability of this new Pittsburgh paint is outstanding; ordinary dirt, finger prints and pencil marks are easily removed with soap and water. Ink stains, however, cannot be satisfactorily removed.

FINISH COAT IN COLOR FOR MASONRY

One coat of Colorthru, a finish coat in color for masonry, manufactured by Colorthru, New York, N. Y., needs no priming or undercoat. One coat brushed or sprayed on floors and walls penetrates, waterproofs, preserves and beautifies concrete, brick, stucco, cement, etc. whether inside or outside, painted or unpainted and can be applied to old or new masonry even when wet. No priming is necessary, effecting a 50 percent saving in labor which usually figures 80 percent of total cost of a paint job. One gallon covers 400 sq.ft.

INSECTICIDES

A toxic solution which acts both as an insecticide and a preventative has been formulated to wage war on the destructive powder post beetle. This beetle is a small prolific insect which causes highly-polished hardwood floors to break out into a sudden rash of small bullet-like holes and strong-looking ax handles to break apart in one's hands like kindling. The laboratory technicians of I. F. Laucks, Inc., Seattle, Wash., have developed a liquid insecticide which not only penetrates the wood cells but also acts as a water-repellent. Besides ridding hardwood of the powder post beetle, it is also effective in counter-acting the effects of many other types of wood borers. This water-repellent type of insecticide is also valuable in treating hardwood flooring in storage.

NEW PLASTIC CONTAINS SILICON

In the September, 1942, issue of *Chem. & Met.* the editors in commenting on plastics of the future stated that a desirable development would incorporate silicon into the molecular structure of a plastic that would combine the advantages of organic and inorganic compounds. Now comes the news that for the first time organic chemicals have been used to make synthetic materials with an inorganic material silicon. The

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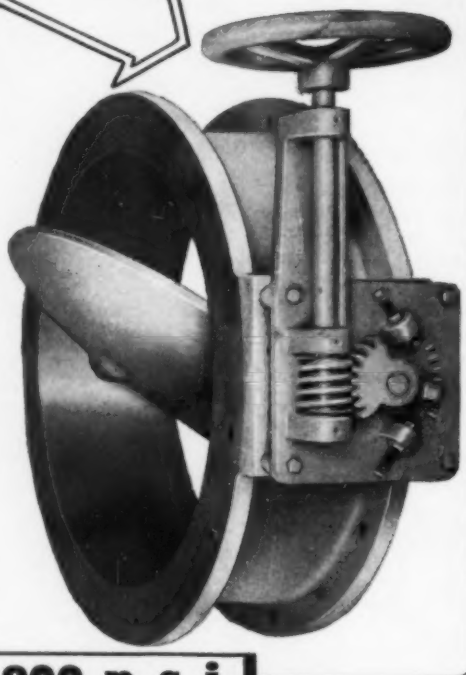
Six revolutions of the hand wheel fully open or close this R-S Butterfly Valve. Compare this quick action with that of ordinary valves. Consider, too, that R-S Valves are comparatively light in weight. They effect a considerable saving in installation costs since less space and supporting structure are required.



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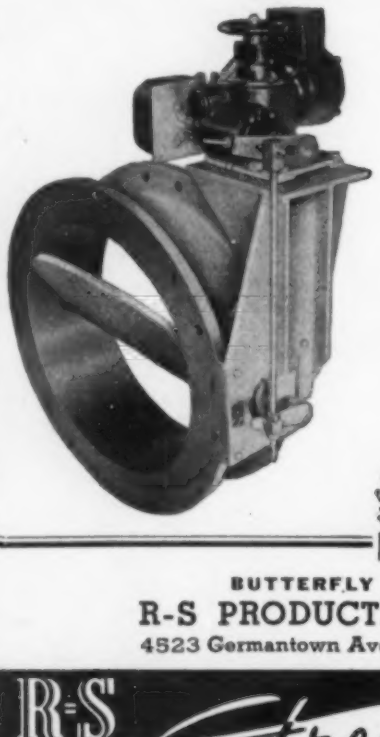

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R-S Streamlined BUTTERFLY VALVES

result is a plastic that will do a lot of things the standard material could not accomplish. As a solid, for instance, its melting point is close to 500 deg. F. The new plastic may be employed as a liquid too. Unlike oils this liquid plastic does not become thick when the temperature goes down well below zero or becomes thin when the temperature soars.

The new plastic can be made in several forms and is known as Silicones. These materials are the creation of the laboratories of Corning Glass Co. and Dow Chemical Co. The jointly owned subsidiary Dow-Corning Corp. has been formed to produce them. Chemically the new materials result from combining silicon dioxide with the methyl or ethyl groups of molecules derived from alcohols, or with ethylene chloride or phenol from coal tar. Both the straight chain or the ring type organic molecules may be used with the silicon giving different properties to the resultant materials. Initial production, it is said, will be small and the cost will be higher because the process is a complicating one thus far. It is expected that production eventually can be greatly simplified.

ICE TIRES

Manufacture of a revolutionary type of airplane tire laced with steel coils to resist skidding on icy airport runways and in arctic and sub-arctic regions has recently been announced by the B. F. Goodrich Co., Akron, Ohio. The winter tire for aircraft, according to J. S. Pedler, manager of the aeronautic division of Goodrich has parallel rows of steel coils embedded in the tread so that the edges grip on ice and snow. The new tires have been made in considerable numbers. Some of them are in service with the armed forces and others are being tested in domestic transport service.

He said tires of this type had been the goal of tire engineers since the beginnings of aviation, but that the search had been intensified lately because the demands of global war require uninterrupted operations in regions where ice runways are used regularly.

The rows of steel coils, Pedler said, are bonded to the rubber around the circumference of the tire during vulcanization. A new method of tire construction had to be developed to accomplish that bonding, he pointed out.

ADHESIVE

Hundreds of thousands of pounds of crude rubber will be saved and crystal clear plastic noses and transparent enclosures for aircraft will flow to assembly lines without interruption because of a new adhesive developed by the Plastics Department of E. I. du Pont de Nemours & Co.

The highly polished, optical surfaces of plastic enclosures must be carefully protected by heavy masking paper against scratching and marring during shipment, fabrication and assembly

Primarily the adhesive had to seal the protecting paper to the plastic through all handling, shipping, fabricating and assembly, because the paper is not stripped off until the plane is ready for its initial flight. It had to withstand extremes of temperature and humidity. The paper had to strip off easily, but not self-strip. It could leave no deposit of adhesive, for cleaning takes time.

Furthermore, the adhesive could have no chemical effect on the plastic and should not cause frosting, crazing, swelling or discoloration. It had to retain its adhesive quality for long periods; it could not curl up at the edges and peel in the sunlight, or while the plastic is being cut, sawed or drilled. It had to be reusable if the paper should be removed during heating and forming operations.

An adhesive meeting these rigid requirements has now been developed. It actually stands up better than crude rubber adhesive in sunlight and does not "crack off" from the plastic. It does not age as fast as crude rubber adhesive and is more uniform in quality. This new adhesive is applied to paper by the same equipment previously used for crude rubber cement. It is being compounded in equipment formerly used to make commercial lacquers. The petroleum base is purchased from an oil company and is dispersed in various chemicals to form the adhesive.

CATALYST FOR GASOLINE

Development of a new catalyst that may step up the quality of high-octane gasoline to the point where it would give 23 to 35 percent more power to supercharged aircraft engines or mean a 13 to 30 percent increase in the yield of aviation gasoline base stock from given crudes was recently announced by the Socony-Vacuum Oil Co., New York, N. Y.

The new agent, a synthetic product, is known as a "bead catalyst" because it is in the form of small spherical particles resembling glass beads. It is translucent and although extremely hard and resistant to wear, is very porous. The function of the bead catalyst is to break down the molecules of crude oil and permit a greater yield of high-octane fuels.

FLOOR CLEANING COMPOUND

A new floor cleaning compound which is said by its manufacturers to eliminate the danger of fire usually inherent in materials sold for this purpose is called Fibre-Tex. It is made by Lacey-Webber Co., Kalamazoo, Mich.

This product is said not to burn when the flame of a blow torch is played directly upon it nor as the result of spontaneous combustion.

It is also claimed for Fibre-Tex that it is highly absorbent of oils and grease and has an active cleaning effect upon floors on which it is consistently applied. Grease and oil-caked dirt are said to be removed; safety stripes and other floor markings are made plainer.

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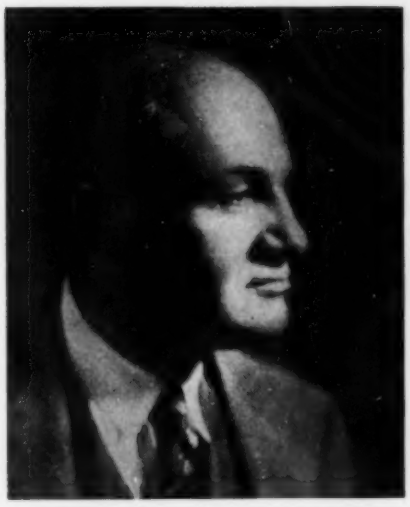
FROM THE LOG OF EXPERIENCE

COOPERATIVE OWNERSHIP of a beet sugar house is based on the proposition that the farmers must take an interest in the factory as a condition precedent to its success. And to foster interest, beet growing must return a profit. The base product of the factory is pure white sugar and this is the item that the sales department is principally concerned with. The farmer delivers the beets which contain the sugar together with potash, sodium, lime and phosphate salts. The sugar is produced out of the air and moisture ($C_{12}H_{22}O_{11}$) while the salts are taken out of the soil. These salts act in the manner of catalyzers without which nature's processes cannot synthesize the sugar elements. They are the items that the farmer must return to his lands, or as Alois Volter puts it, "he is a thief of his own fields." After as much of the sugar is removed as is practically possible, the pulp and molasses should be returned to the farm where the final refinement is accomplished in the digestive apparatus of the farmer's stock and the residue, immediately assimilable for plant development, is returned to the soil to complete Nature's cycle.

A beet sugar factory in California once published the following interesting statistics showing how factory operations are planned to insure that the cycle is completed to the advantage of all.

Acres harvested	13,585
Tons of beets	202,000
Sugar produced, lb	62,000,000
Molasses sold	$180,000
Beet pulp sold for consumption by livestock at factory feed pen	$70,000
Manure from feed pen sold to farmers	$15,000

AT THE TURN of the century, youthful Sam Cranage had been earmarked for a seafaring career, although later he was to be connected with the Michigan beet sugar industry. While he was traveling on his father's ship he busied himself by counting engine revolutions by the aid of a crude counting mechanism. After a time he was able to convert revolutions into miles by which he could forecast the ship's position to the master when fog reduced visibility. The master was amazed with Sam's accuracy and surprised other navigators by his ability to steer through the old narrow Soo River on foggy, starless nights. Among Sam's heirlooms there was a large file of ancient documents not all of which pertained to sugar. A few years ago he unearthed a folder containing three impressively engraved United States bonds, dated 1853, aggregating $55,000,000 face value, one of which was endorsed by important French diplomatic representatives in Washington. The manner of the acquisition of



Dan Gutleben, Engineer

these bonds is shrouded in mystery. However, their discovery brought Sam considerable front page publicity and a deluge of solicitations from all parts of America. There were pleas and demands for contributions to personal and public charities. A widow from Chicago was especially cordial. She hoped his health was good and she would esteem it a great privilege to develop his acquaintance. She was presently vacilating between the urge of California and Michigan. However, she loved Michigan. The United States Treasurer sent a representative to Sam's office with a camera and subsequently sent notice that the bonds were without value. Nevertheless a legal wiseheimer urged that the opportunity to exploit the gullibility of great American gamblers should not be overlooked. He proposed the flotation of a stock company to raise funds for the prosecution of an effort to collect from opulent old Uncle Sam at Washington.

A CHAR FILTER was once left full of liquor at the week-end according to long-standing custom, except that the filling pipe between the filter top and the supply tank overhead was inadvertently shut off. The cast-iron filter 10 feet in diameter by 25 feet deep full of liquor, was therefore hermetically sealed. It happened that the liquor was of low quality and low density and therefore invited fermentation. Evolution of CO_2 got under way. The liquefying pressure of CO_2 at the temperature existing in the char house was about 1,500 pounds per square inch while the ultimate structural resistance of the filter is barely 150 pounds. Early on Monday morning before the starting shift arrived, the inevitable took place. Woosh! What a mess! Fifty tons of liquor, twenty tons of splintered cast iron. Price $8,000.

To avoid a recurrence the filters were thereafter "blown down" at the week-end and refilled on Monday morning, thereby wasting 1½ hours of operating time on each filter. When Frank Harvey took over the supervisory duties, he ordered return to the former time-saving procedure, but made sure that the connections between the top of the filters and the supply tanks were left open. It happens occasionally that a meritorious procedure exhibits a slight weakness chargeable to human derelict and immediately the procedure is condemned.

An ancient army post once received a fresh coat of paint. To avoid spoiling the clothes of users of the facilities who did not believe in signs a sentinel was directed to patrol the vicinity, but patroling became a habit and continued for years after its purpose was forgotten.

CONTRACTING EXPERIENCE in which all of the expenditures for labor and materials come out of the private treasury, makes an engineer into a careful "Scotchman". It develops a complex of pain at the sight of waste. Woolgathering is followed by a kick in the pants or the pocketbook. To carry out contracts in a highly hazardous and competitive field and maintain solvency, requires development of the habits of thrift and orderliness. By the time the whistle recalls the craft to labor, every man has his job laid out for him and his materials are at hand. Ennui is dispelled by the abruptly changing experiences and surprises. Ingenuity pays.

The second floor of Howard Smith's long narrow building was leased to printer Barry who arranged his presses crosswise of the building. The reciprocating plungers imparted an uncomfortable rocking to the building for which the lessee's engineer prescribed a forest of braces in the first story. For the price of one Saturday afternoon's work of a crew of riggers, we rearranged the presses parallel to the long brick side walls and thus absorbed the jolts.

A GRASPING PLUMBER had secured the contract for the plumbing. Howard decided that the contract included a dozen more fixtures than he needed, but hesitated to make a direct request for a price adjustment lest there should be a sudden upswing in the market! He therefore called the plumber into conference, and while I was present, notebook in hand, he asked the plumber how much

FLEXPEDITE

Your Conversion—Assembly—Production with

REX-WELD
Flexible Metal Hose

Rex-Weld Hose—Annular Corrugations

RW-90 Unbraided ——— RW-91 Braided

Rex-Weld Hose—Helical Corrugations

RW-90 Unbraided ——— RW-91 Braided

General Data

	STEEL	BRONZE
Sizes	To 4" I.D.	To 4" I.D.
Pressures	To 14,500 p.s.i.	To 14,500 p.s.i.
Temperatures	To 1000° F	To 450° F.
Lengths	To 50'	To 50'

Use Chart

	*STEEL	BRONZE
Saturated Steam		✓
Superheated Steam	✓	
Sulphur Bearing Oil	✓	
Oxygen		✓
Ammonia	✓	
Carbon Dioxide	✓	
Sulphur Bearing Grease	✓	
Critical Vibration		✓
Non-Sparking		✓

*Protective Coatings Can Be Applied for Corrosion Protection (To Conserve Critical Copper Bearing Alloys).

Couplings: REX-TITE Mechanical (Re-attachable) Couplings; Solder Couplings; Brazed and Welded Couplings and Flange Assemblies for Rex-Weld Flexible Metal Hose.

Ask for Engineering Recommendations

CHICAGO METAL HOSE CORPORATION

General Offices: MAYWOOD, ILLINOIS

Factories: Maywood and Elgin, Ill.

he would charge for twelve more fixtures. The plumber overreached himself exactly as Howard had anticipated. Quick as a flash, Howard said, "After all, I want those twelve fixtures on the mezzanine floor omitted. Dan, make a note of the amount and deduct it from the plumber's contract. Let's go!" With the reduction in the amount of work, the plumber was of course still entitled to his overhead, but his attempt to take excessive advantage, and Howard's quick wit left him speechless.

TOM STOCKMAN, Major Domo of our Power Plant, once got himself a job at Baugh & Sons' bone char factory. They were having a lot of trouble with their old return tubular boilers. The fireman said the draft blew the smoke into his face. They were shoveling coal vigorously and just as vigorously pulling out unburned clinkers to keep the grates clear. There was evidently lack of intelligence in the art of boiler operation. In the smoke flue above the boilers there was installed a small superheater. This mystified Tom and he decided next Sunday to investigate. He found the area plugged with soot and he worked like a sailor to get it cleaned out before night. On the morrow, two boilers were able to handle the load that four failed to carry before. Thereafter, when the manager made his daily trip through the boiler house, as luck would have it, Tom happened always to be relaxing in his chair. The Boss requested an explanation. "Well," said Tom, "I've got steam up and water in the gage; it's costing less while I'm sitting than while I'm shoveling." The answer clicked. Tom drew a raise in pay!

During Tom's employment at Baugh's, the shift engine man had a thermometer hanging in the engine room which he frequently consulted. This thermometer had a cup over the bulb used for dipping into a liquid to ascertain the temperature. Just as time drags for a man who frequently consults the clock, so the heat of the Summer palled the engineer as he observed its height. On a particularly hot day the mercury registered 110 and the engineer complained to Tom that he felt unequal to the task of carrying on. Tom told him to sit down and he would slip into the engine room from time to time to inspect operation. Then Tom filled the thermometer cup with cold water and remarked that he believed the temperature was dropping. The engineer then ventured within and shortly thereafter there issued from the engine room windows the familiar whistling of contentment!

WE BUILT a mill building in Berkeley and when the job was finished were asked by wire if we would be willing to build a duplicate of this plant in Ontario. Ontario is a little village in southern California which was on our beat, and the proposition was accordingly accepted. In reply, we were asked whether it would be possible for us

to stop off at Niles, Michigan, en route. This illuminated the situation for us. The job was, in fact, in Guelph, Ontario, 2,000 miles from San Francisco. Anyhow, I went up to have a little fun accompanied on the trip by native son Irving. The rumor of our arrival beat us to the job and we found several hundred men waiting at the site with their lunch bags. We picked out about a hundred, including one gentleman of color who was the only African in Canada! Irving scribed a circle around the latter about 5 ft. in diameter and then told him to dig. The rest of the crew proceeded with the foundation. At 6 o'clock in the evening, which was the end of the work day, Irving heard some hollering from the direction of the circle. He found the Ethiopian 12 ft. below the surface and unable to get out of the hole. He had taken his tools and lunch with him and one of the men nearby occasionally had shoveled back the excavated material and provided drinking water. Irving had forgotten to give him a 5 ft. measuring stick to indicate the limit of the depth.

JOE'S STYLE of humor revealed itself in subtle manner when the insurance agent was importuning him for business. Joe expressed regret that it was presently impossible to confer in the office as it was the time for his tour of the shops. However, the agent was invited to accompany him and to describe his wares during this perambulation. Joe's path led straight to the boiler shop where the din of sledges and riveters made the voice impossible as a means of communication.

WHEN THE SHACKAMAXON ferry was still in operation, a freighter once hit the ferry boat as a result of some confusion of orders. Wiseheimer Bill Burke, the belt man, delighted in bandying such nautical terms as starb'rd and port. He had a desire to exhibit his knowledge of maritime affairs by establishing guilt for the collision, and so inquired of Tom where the freighter hit the ferry. Tom, landlubber that he is, answered, "On the outside." Bill agreed, "Of course, of course. I know she didn't jump down the hatch and hit from within!"

A SAN FRANCISCO city ordinance prohibiting the use of garbage for hog feeding encouraged old man Turner to come from the East with the intention of building a plant for reclaiming soap grease and chicken feed from hotel garbage. In due course of time we helped in the selection of a site near Hunter's Point in San Francisco and built a handsome plant for $125,000. Operations got under way and promised profits. Then a city supervisor who had formerly owned a hog farm in the suburbs, induced his colleagues to join him in repealing the ordinance that had banned feeding garbage to hogs and had put him out of business. Turner sold his works to a soap company as the complicated plant which cost money to

"Specify CONTINENTAL"

BELT CONVEYOR IDLERS

There is a size and type of Continental Idler for every Belt Conveyor application. All idlers, regardless of type, have several improved features common to all. Idler Rolls of all types are easily removed from supporting brackets by simply lifting them out, which can be done with five and six-inch diameters of either cast iron or steel to suit conditions, and of course are equipped with "anti-friction" bearings.

Grease seals are of all-metal labyrinth type, having five passes with the inner members protected from damage by malleable iron nuts. Time has proven that these seals will keep both dirt and water from getting to the bearings. Malleable nuts serve three purposes:

(A) Right and left-hand threads make possible minute adjustments of bearings.

(B) Sloping surfaces shed dirt and matter, preventing it from entering bearings.

(C) Recessed groove in nuts fits down over sloping brackets, giving a sturdy support to rolls as well as tying brackets together.

Supporting brackets are made of certified malleable iron and amply ribbed for strength. Upper ends of brackets are made in the form of inverted "V" to shed dirt. Brackets are rigidly attached to inverted angle or channel bases, as may be desired. This construction gives a one-piece unit in a simple rigid design.

Bulletin ID-103 fully describes the Continental Idler and gives twenty-one reasons why these Idlers have gained immediate acceptance by industry. Send for your copy today.

INDUSTRIAL DIVISION

CONTINENTAL GIN COMPANY

ATLANTA, GA. BIRMINGHAM, ALA. DALLAS, TEX. MEMPHIS, TENN.

YOU NEED THESE TWO EVERLASTING VALVE FEATURES . . .

1. Tightness

. . . is assured and maintained by the self-grinding seal of the Everlasting Valve. The disc moves across the seat in a rotating motion and is in constant contact with the seat, thus regrinding the disc against the seat whenever the valve is opened or closed.

2. Resistance to wear

. . . is provided by the constant spring-maintained contact of disc and sealing surface which prevents grit from getting between the sealing faces of the Everlasting Valve disc and seat.

TYPICAL SERVICES WHERE EVERLASTING VALVES EXCEL

- Outlets of storage and measuring tanks
- Throttles of hammers and hoists
- Presses for plastics
- Washers for laundries, cleaners and dyers
- Spray lines to rolls
- Blow-offs of condensers, economizers, vulcanizers, purifiers, compressed air tanks
- Suitable for acids, alkalies, caustics, cellulose, coal tar, emulsions, syrups, and other liquids; also gases and vapors

Write for Bulletin

EVERLASTING VALVE CO., 49 Fisk St., Jersey City, N. J.

Everlasting Valves

for everlasting protection

build and to operate could not compete with the hogs.

A hog is a portable garbage reducing plant with automatic technical supervision and otherwise completely equipped with elemental machinery for stoking, digesting, extracting and refining. It has an efficient power plant and carries its own department of repair and maintenance. It doesn't pay taxes and it doesn't have to submit to collective bargaining or to contribute to the support of indigent and other human impedimenta. Its sole performance is pork production with a single by-product which is thrown over the fence to assist nature in the propagation of vegetable products.

A GLUE FACTORY not far from the garbage plant was easily located by following one's nose. Absence of competition in glue manufacture on the West Coast made plant efficiency an academic subject somewhat like swimming to a philosopher. However, when an earthquake began rocking the four-story timber frame building, psycho-analytical readings had no virtue. We prepared a stress analysis and found timbers loaded to 50,000 lb. which had slipped within 2 in. of their supporting posts! By instructions from Kindlespire, the operator, we pulled the structure together and braced it with steel rods and turnbuckles. My departure greatly relieved him as he was in continual fear lest I should pick up some of the alchemy of his art. I called his attention to the fact that notwithstanding his forty years practice, he was still losing an occasional kettle of glue.

After doing a thing wrong a few thousand times, he had stumbled onto the correct method, and he placed a value thereon in proportion to its cost in effort and wasted glue, whereas the market price of some of his highly prized secrets is now an hour's lecture to a freshman. I suggested that a young Bachelor of Science from the University of California, if attached to his staff, could apply his tools to determine effective operating technique and would accomplish more in a few years than had been done in the past forty years. He followed the suggestion and after a couple of years his mystery began to develop into a science. The yield of glue per ton of raw material increased. However, he did not relish a challenge to his supremacy as master gluemaker on the Pacific Coast and accordingly discharged the chemist. When competition, assisted by freight reductions at the completion of the Panama Canal, began to crowd him from the East, his business sagacity asserted itself and he sold his plant to his Chicago competitor.

ONE of our polanders was listed as a casualty a few weeks ago. The record in the dispensary calls it "severe burn on the belly." He was hanging the shirt above the radiator to dry and thus exposed the bare protuberation to a safety hazard.

PERSONALITIES

Alphonse Pechukas

Photo-Crafters

C. L. Baker

✦ALPHONSE PECHUKAS has been appointed research director of Columbia Chemical Division of Pittsburgh Plate Glass Co. Dr. Franklin Strain has been appointed assistant research director of the Division. Dr. Pechukas, who has been serving as acting director since May, 1942, first entered the company's chemical division in 1937 as a laboratory research worker. He is a graduate of the University of Chicago. He is only 28 years old and hence has the distinction of being one of the youngest directors of research in the industrial field. Dr. Strain received his Ph.D. degree in organic chemistry from the University of Kansas in 1933.

✦WILLARD P. CONNOR, JR. is acting leader of the recently established technical group at Hercules Experiment Station. The group has been organized to coordinate and develop physics work.

✦CHESTER MALYSIAK, chemical engineering graduate of Purdue University, has been appointed to the research staff of Battelle Memorial Institute where he will assist in the conducting of research in the division of non-ferrous metallurgy. Mr. Malysiak has held chemical and metallurgical positions with the Bingham Stamping Co., Owens-Illinois Glass Co. and Continental Steel Co.

✦ROGER W. ALLEN, district sales engineer for Foxboro Co., Atlanta, Ga., for the past six years, has been named Southeastern district manager for Wheelco Instrument Co., Chicago, with headquarters in Atlanta.

✦HERMAN FRANCK, who had been general superintendent of the Dunkirk, N. Y., plant of American Locomotive Co. was recently named plant manager to succeed the late Edmund F. Boswell who died last November.

✦CHESTER L. BAKER, chemical director of the Philadelphia Quartz Co., Philadelphia, has been named vice president of manufacturing and engineering. Early in 1927 Mr. Baker became chief chemist of Philadelphia Quartz Co. of California, Ltd., and in 1935 he was transferred to the Philadelphia office. Two years ago he was appointed chemical director which title he retains.

✦RALPH B. MILLINGTON, formerly of the Stevens Paper Mills, is now connected with the Carter Ink Co., Boston, Mass. as chemical engineer.

✦A. S. MUSSELMAN, who has been superintendent of the heavy oils department of the Whiting refinery of Standard Oil Co. of Indiana has been promoted to the position of assistant general superintendent. G. F. Ordeman, who has been superintendent of the light oils department also has been made assistant general superintendent. F. V. Grimm will take Dr. Musselman's place as head of heavy oils and Arthur F. Endres will move up to the former position of Dr. Ordeman. Dr. Musselman began working for Standard Oil in 1917 as a research chemist at Whiting two years after taking a Ph.D. degree at Johns Hopkins. Dr. Ordeman started work at Whiting in 1919 as research chemist after graduating from Washington and Lee University and Johns Hopkins.

✦LEONARD G. REICHHARD, production manager of National Lead Co. has been elected a director of the company and appointed a member of the executive committee to succeed the late H. G. Sidford.

✦PAUL WOOTON who heads the Washington Office of the McGraw-Hill Publishing Co. has been elected president of the White House Correspondents' Association.

✦THOMAS R. VAUGHAN has been elected assistant secretary of Freeport Sulphur Co. by the board of directors, Langbourne M. Williams, Jr. recently announced.

✦NORTON MCKEAN has been elected president of American Meter Co. to fill the vacancy caused by the recent death of Mr. Francis H. Payne. Mr. McKean was formerly vice president, treasurer and general manager.

✦FRANK J. SODAY has resigned as assistant manager of the chemical laboratory of the United Gas Improvement Co. to become technical director of the Copolymer Corp. of Louisiana. This corporation will operate a synthetic rubber plant of the Rubber Reserve Co.

✦WILLIAM P. HEADDEN has been named supervisor of the fuels and lubricants section of the Engineering Division of Esso Marketers. Mr. Headden has been active in the engineering division of the company for 14 years.

✦CHARLES W. BOHMER, JR., who has just been appointed assistant supervisor of fuels and lubricants section, is a graduate of the University of Pennsylvania. He worked as a chemical engineer at the Standard Oil Development Co. and was transferred to the Field Service Division in 1933. When this Division was transferred to the Standard Oil Co. of New Jersey he came with it as a lubrication engineer.

✦W. P. DOHNE, who was formerly connected with Michigan Alkali Co., is now associated with the Rising Paper Co., Housatonic, Mass.

✦WILLIAM G. VAN BECKUM, formerly of Wood Conversion Co., has been transferred to the new development laboratory of Weyerhaeuser Timber Co., Longview, Wash.

✦H. W. VAHLTEICH, recently appointed vice president in charge of research and quality control of the enlarged Best Foods, has been with the company since 1924.

✦HARRY S. WHELLER was elected president and general manager of L. J. Wing Mfg. Co., New York, N. Y., at a recent meeting of the board of directors. Mr. Wheller, who has been vice president since 1917, succeeds the late Alfred E. Seelig as head of the company.

✦NELDON HOYT, formerly production manager for Allied Products Co., Suf-

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• FOUNDRY
• MACHINE SHOP
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STAINLESS-STEEL VALVES

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If you looked under the roof of the Cooper stainless-steel valve plant, you would find...an engineering design department... a foundry for casting valve bodies and parts...and a modern machine shop. In short, a complete valve plant from idea to finished product, all under one roof.

In the manufacture of stainless-steel valves this is important...because (1) stainless-steel is difficult to cast, (2) stainless-steel is difficult to machine, and, as a consequence, (3) a stainless-steel valve is difficult to design. Only when these three phases of manufacture are coordinated under one roof and one management can a truly fine valve be produced.

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Gate, globe angle and check valves ... screwed and flanged fittings ... made of 18-8 stainless steel or other special alloys resistant to corrosion, heat and abrasion. Write for our fact-filled catalog.

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All Cooper valves and fittings finished by exclusive LUSTRACAST process which improves corrosion resistance.

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fern, N. Y., has joined Evans Chemetics, Inc., New York, N. Y., as production manager.

✦ MARY M. DONOVAN, former graduate assistant at the University of Pittsburgh, has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Miss Donovan is a graduate of Carnegie Institute of Technology from which school she holds a Bachelor of Science degree in chemistry, and of University of Pittsburgh where she obtained a Master of Science degree. She also attended Thiel College.

✦ CLARENCE P. HARRIS, industrial chemist, formerly located at New York announces that he has closed his office and laboratory for the duration of the war in order to devote all of his time to the war effort.

✦ JACK SANDLER has joined the staff of Aircraft Parts Development Corp. Summit, N. J., as chief plastics engineer and will head the corporation's work of exploring the rapidly increasing use of plastics in airplane construction and equipment. Mr. Sandler's former activity in plastics engineering was with the Northern Industrial Chemical Co. and the Nixon Nitration Works.

✦ CONRAD A. ELVEHJEM, professor of biochemistry, University of Wisconsin, has been awarded the 32nd Willard Gibbs Medal of the Chicago Section of the American Chemical Society that is awarded each year in special recognition of eminent work in and original contributions to pure or applied chemistry. The medal is awarded to Dr. Elvehjem for his studies involving trace elements in nutrition.

✦ P. W. LEPPLA has been appointed to the position of chief chemist of Cardox Corp. Dr. Leppla will make his headquarters in the general offices of the company in Chicago reporting to Dr. Charles A. Getz, director of the research division.

✦ JOHN M. DAVIES, in the research division of B. F. Goodrich Co. since 1926, has been named director of physical research.

✦ L. G. BEAN has been appointed vice president in charge of engineering and sales for the Bristol Co., Waterbury, Conn. Mr. Bean has been vice president and general sales manager since 1939.

✦ CHARLES GLENN KING has been awarded the 1943 Pittsburgh Award bestowed annually for outstanding achievement in chemistry by the Pittsburgh Section of the American Chemical Society. Dr. King is visiting professor at Columbia University and scientific director of the Nutrition Foundation, with headquarters in New York City. He is on leave as professor of chemistry and director of the Buhl Foundation Research Project at the University of Pittsburgh.

✦JOHN F. ELLIOTT, U.S.N.R. of St. Paul, Minn., has been awarded $100 national prize of the American Institute of Mining and Metallurgical Engineers for the best paper on mining and metallurgy written by an undergraduate last year. Ensign Elliott's prize winning paper reported on research he did during his junior and senior years at the University of Minnesota on the subject of substitution of antimony and arsenic for tin in soft solder.

✦JAMES A. DAVIS, former metallurgist with the Colorado Fuel and Iron Corp., Pueblo, Colo. has been appointed to the technical staff of Battelle Memorial Institute. He has been assigned to metallurgical research related to the war effort.

Nelson W. Pickering

✦NELSON W. PICKERING, U.S.N.R., was ordered to report for active duty in the United States Navy on February 1, and accordingly resigned as president of Farrel-Birmingham Co., Inc. of Ansonia, Conn., and Buffalo, N. Y. Captain Pickering has been assigned to duty as commander of the U. S. Navy Section Base at New London and commander of local defense forces in that area.

✦JAMES R. TURNBULL of Monson, Mass., recently was appointed chief of thermoplastics unit of the Plastics and Synthetics Rubber Section, Chemicals Division, WPB. Mr. Turnbull succeeds Dr. Ralph H. Ball who resigned January 1 to return to his position with the Celanese Corp., Newark, N. J., as assistant technical director. Mr. Turnbull had previously served as assistant to Dr. Ball, specializing in vinyl polymers and polystyrene and assisting in the administration of thermoplastic control orders.

✦CHESTER F. CONNER, manager distributor sales, Industrial Products Division, B. F. Goodrich Co., has been appointed to the staff of advisers on mechanical rubber goods in the Office of Rubber Director, WPB.

✦G. M. BUTLER, formerly research engineer in Dunkirk Laboratories of Allegheny-Ludlum Steel Corp. has been

6 WAYS* TO DO A BIGGER WAR JOB WITH STAINLESS STEEL EQUIPMENT

One of the engineering rooms at S. Blickman, Inc.

#6 COLLABORATE WITH YOUR FABRICATOR...

To accomplish the miracles of production needed to win the war, the processing industries must take full advantage of the benefits of stainless steel equipment. High output, low maintenance and long service life can be built into your equipment if the conditions of operation are accurately known to your fabricator. Often, your fabricator may suggest improvements that will effect a higher yield throughout the life of the equipment.

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When you have chosen such a fabricator, take advantage of his engineers' "know-how". Cooperate with them in the planning of your equipment, *right at the drawing board.*

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EST 1889

Heavily Loaded Liquids *Do Not Faze These Pumps* . . . . . .

While they handle clear liquids, Amsco-Nagle Centrifugal Pumps just as effectively handle heavily loaded liquids. Wide impeller clearance and slipstream impeller design reduce friction and are responsible for the high degree of hydraulic efficiency in both the horizontal and vertical shaft types.

Particularly noteworthy is the performance of Amsco-Nagle vertical shaft pumps. In installations calling for this type of unit, vertical shaft pumps have a chance to prove their efficiency and Amsco-Nagle Pumps have proved their worth on numerous occasions. A 1½″ type "SD" dry-pit pump with overall length of 25 ft. and total operating head of 48 ft. is satisfactorily handling sand-laden locomotive boiler makeup water to a settling system, for a western railroad.

Another Amsco-Nagle Pump, a 2″ type "SW" wet-pit unit, shown, is performing admirably handling syrup in a raw sugar refining process at a Michigan beet sugar refinery. Like all Amsco wet-pit pumps, it has an inverted inlet. That is, liquid enters the water end from the top. This design eliminates air or gas binding and utilizes hydraulic thrust to counterbalance the weight of the revolving parts.

The supporting structures between water-end and floor plate both have an added purpose; one serves as a discharge pipe and the other serves as a conduit for lubricant to the submerged bearing, which is retained in a split yoke.

This particular pump is equipped with a screen on the entrance side to keep back large lumps of sugar from the dissolver.

Many processing plants have found that Amsco-Nagle Pumps are designed to eliminate pumping problems frequently experienced. The present wartime need for smooth, constant operation suggests their use. We will be glad to review your pumping problems where the handling of solids suspended in liquids or viscous liquids is concerned, and submit recommendations without obligation. Send for a copy of Amsco-Nagle Industrial Pump Bulletin 940.

Amsco

AMERICAN MANGANESE STEEL DIVISION
OF THE AMERICAN BRAKE SHOE & FOUNDRY CO.
Chicago Heights, Illinois
FOUNDRIES AT CHICAGO HEIGHTS, ILL.; NEW CASTLE, DEL.; DENVER, COLO.; OAKLAND, CALIF.; LOS ANGELES, CALIF.; ST. LOUIS, MO.
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Genuine Manganese Steel, "The Toughest Steel Known"
Chromium-Nickel Alloy Castings for heat and corrosion
Power Shovel Dippers. Dredge and Industrial Pumps
Welding Materials for reclamation and hard-surfacing

named chief metallurgist in charge of technical control and research. At the same time, R. T. Eakin was appointed assistant metallurgist at the same Allegheny-Ludlum plant.

✦J. Warren Kinsman has been appointed assistant general manager of the Organic Chemicals Department of E. I. du Pont de Nemours & Co. to succeed the late Cesare Protto. Dr. J. A. Almquist will succeed Mr. Kinsman as assistant general manager of the Plastics Department.

✦Willard Holmes, who for 15 years was a primary examiner of the United States Patent Office, has resigned to enter private practice in the chemical patent field. Prior to coming to Washington, Dr. Holmes was professor of chemistry at the University of Chattanooga. He will take over the practice of Paul D. Boone who is doing war work for the government. The name of the new firm in Washington is Holmes and Boone.

✦J. Earl Taylor, formerly with the research department of the Procter & Gamble Co., Cincinnati, is now with the Girdler Corp., Louisville, Ky., in charge of a research group. Dr. Taylor has spent the past 14 years in research on catalysts and catalytic processes for the production of hydrogenated glycerides, alcohols and similar products.

✦A. A. Azar, formerly of Koppers Co., Bartlett-Hayward Division of Baltimore, Md., has joined the engineering staff of the Girdler Corp., Louisville, Ky. Mr. Azar has spent 14 years in the design, construction and operation of numerous types of gas plants and engineering development of new processes such as the heavy oil cracking process.

✦D. L. Beeman has been appointed engineer, industrial power section, succeeding E. G. Merrick, and R. S. Sage has been named engineer, mining section, succeeding F. L. Stone, it was announced recently by J. D. Wright, manager of General Electric's industrial engineering department. Mr. Merrick and Mr. Stone, both of whom have been associated with the company for many years, will continue in their respective sections with specially assigned duties and as engineering consultants. Mr. Wright also announced the transfer of petroleum industry application engineering responsibilities from the mining section to the chemical section headed by T. R. Rhea. This section will now be called the petroleum and chemical section.

✦Angus G. Scott has recently been appointed sales manager of the Derry, Pa., porcelain department of Westinghouse Electric & Mfg. Co. Mr. Scott, a chemical engineering graduate of the Case School of Applied Science in 1921, succeeds R. L. Whitney, who has been named sales manager of the Westinghouse Transformer Division at Sharon, Pa. Before his new assignment Mr. Scott was manager of the line material section in the Transportation and Generator Division at East Pittsburgh, a

post he held since 1937. The new Derry sales manager was born in Cleveland, Ohio, 43 years ago. He attended Cleveland Central High School and served in the Navy during the first World War. For 14 years he was employed by the Cleveland Railway Lines, becoming superintendent of power distribution in 1930. He joined Westinghouse five years ago.

✦NEIL F. ROBERTSON, formerly with the Scott Paper Co., Chester, Pa., and Pulp Bleaching Co., Wausau, Wis., has accepted a position in the research laboratory of the Crosset Lumber Co., Crossett, Ark., where he will work in the Pulp and Paper Division.

✦HARRY E. NORDIN, JR., has joined the field technical force of the Dicalite Co. Mr. Nordin will cover the eastern and northeastern territory out of New York rendering practical technical service to plant owners. His experience in the dry cleaning industry was gained with such firms as the Speare Supply Co., Chicago; Armour & Co.; Patek & Co. on the West Coast, and others.

✦D. W. PRICHARD, who holds a B.S. degree in chemistry from Pennsylvania State College and who was formerly associated with W. H. & L. D. Betz, of Philadelphia, consulting chemical engineers, has joined Quaker Chemical Products Corp., of Conshohocken, Pa. He has been assigned to the technical sales division of the company. An addition to the research laboratory staff of the company is Mr. Tulio Cordero, a graduate of the University of Cincinnati and the George Washington University. He was formerly connected with the United Drug Co. in Boston. Dr. Boris Schwartz, who received his Ph.D. in organic chemistry from Rutgers University last spring has also joined the research laboratory staff of this organization.

✦FRED C. SMITH has been appointed chief metallurgist of Tube Turns, of Louisville, Ky. From 1936 to the date of his present affiliation with Tube Turns, Mr. Smith was employed by Carnegie-Illinois Steel Co. at Chicago in the capacity of field metallurgist. Prior to that he was plant metallurgist for the International Harvester Co. at Fort Wayne and Chicago plants.

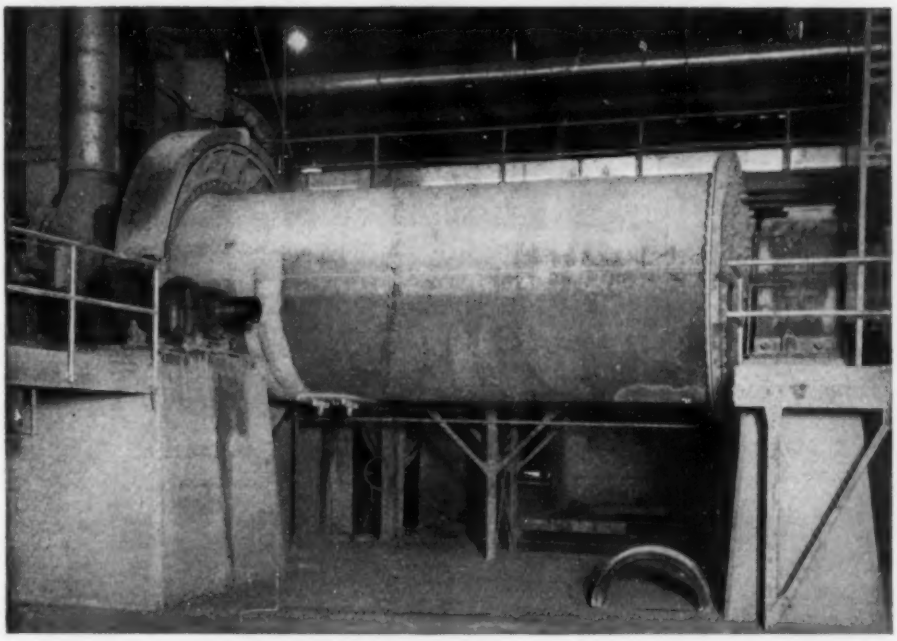
✦WILLIAM L. LUACES, CAC(AA) was recently transferred from Camp Davis, N. C., to Fort Eusted, Va. and ordered thence to the Army Intelligence School in Maryland. Lieutenant Luaces is on leave as vice president of Research and Development Corp., Wilmington, Del.

✦H. E. OUTCAULT has been elected chairman of the New York Section of A.I.Ch.E. for 1943. The newly elected vice chairman is Joseph Mattiello, and the secretary-treasurer is Emerson J. Lyons.

OBITUARIES

✦MASON HULETT of Farrel-Birmingham Co., Inc., of Ansonia, Conn., and Buf-

TRAYLOR



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★ The most familiar conception of the term "grinding mill" is of a cylindrical machine in which material is ground fine by impact of various kinds of media. The manufacture of such a unit is comparatively easy, but there is a wide gulf between one merely fabricated of so much steel plate and sundry castings, and one into which is built, also, *a complete understanding of the work that the machine is to do and the results that are expected.* This latter marks the difference between Traylor Grinding Mills and the common garden variety, and it is also the reason why our machines have been preferred, during many years past, by engineers who "know their stuff," in the chemical and process industries.

★ In a very real sense, each Traylor Grinding Mill is built to order, because our engineers always find necessary some departure from "standard," in order to *fit exactly what they know to be* the needs of the customer in process of being served. So, whatever material it may be that you wish to grind, or whatever is the quantity you wish to produce, consult these engineers *first.* No obligation, of course! You cannot lose when you lay your bet on Traylor! Write us soon!

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Tops

IN THE BASIC REQUIREMENTS OF A GOOD RASCHIG RING

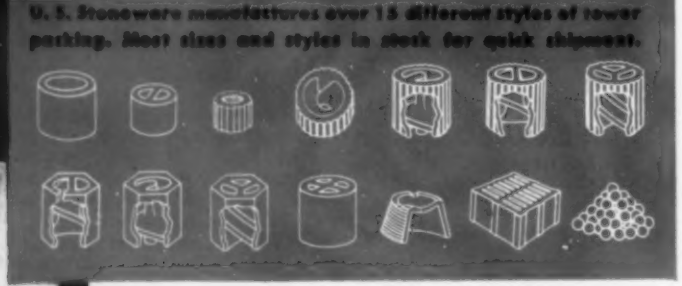
"U. S." white porcelain or chemical stoneware raschig rings are outstanding in the fundamental qualities required of a good raschig ring: *mechanical strength, chemical purity, and uniformity.*

Vitrified at temperatures of 2500 deg. F., "U. S." raschig rings cannot soften or crumble. Their extremely low co-efficient of thermal expansion prevents chipping, cracking, or spalling under rapid heating or cooling.

Our non-absorbent, zero-porosity, iron-free, white porcelain bodies permit easy and thorough flush cleaning, eliminating the danger of contamination or discoloration of following solutions.

They are unreservedly guaranteed, as is chemical stoneware, to be inert to the action of all acids, solvents, and corrosive solutions, with the exception of hydrofluoric acid and hot alkalies.

Write for Bulletin No. 54 on Modern Tower Packing



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In Canada: Chamberlain Engineering, Ltd. Montreal

Would you like to be able to determine quickly the resistance of various styles of tower packing to gas flow? Would concise reference tables showing percentage of free gas space, square feet of exposed absorption surface per cubic foot of packing, relative scrubbing capacity, etc., be of help to you?

Write today for a copy of U. S. Stoneware's new Bulletin on Modern Tower Packing. Filled with valuable information every chemical engineer needs, this bulletin will be sent without cost or obligation, on request. Write Department P, U. S. Stoneware Company, Akron, Ohio.

falo, N. Y., died suddenly February 7 in Washington, D. C. Mr. Hulett was widely known throughout the gear industry having been connected with the New York office of Farrel-Birmingham for the past nine years as sales engineer and consultant on gears.

✦ STANTON HERTZ, vice president and assistant to the president of the Copperweld Steel Co., Glassport, Pa., lost his life in a fire in his home at Pittsburgh, Pa. on February 27. Mr. Hertz was born in Montgomery, Ala., on June 17, 1894 and was a graduate of Alabama Polytechnic Institute in 1921. He started his career with Copperweld and served successively as chief engineer at the New York office, general manager of sales, and vice president.

✦ GEORGE H. BROWN, who had been granted a leave of absence last fall from Rutgers University because of illness, suffered a stroke recently, at St. Petersburg, Fla. He was 59 years old. Professor Brown was Director of the Department of Ceramics at Rutgers.

Walter Kidde

✦ WALTER KIDDE, engineer, manufacturer and civic leader died suddenly at his home in Montclair, N. J., on February 9. He was 65 years old. Mr. Kidde was the founder and president of Walter Kidde & Co., manufacturers of life-saving and fire-extinguishing apparatus.

✦ ALBERT H. REIBER, vice president in charge of development and research for the Teletype Corp. of Chicago, died at Mayo Clinic in Rochester, Minn., February 1.

✦ FRANCIS J. POND, director of the Morton Memorial Chemistry Laboratory at Stevens Institute of Technology and a consultant in chemical research died in Montclair, N. J., February 18 of a heart attack. He was 71 years old. Dr. Pond became affiliated with Stevens Institute in 1903 as assistant professor of engineering chemistry. For many years he was freshman dean at Stevens and formerly held the position of treasurer of the Stevens Athletic Association. Dr. Pond received an honorary degree of Doctor of Science from Stevens in 1929.

MEETINGS AND CONVENTIONS

Electrochemical Society and American Chemical Society Make Plans for April Conventions

ELECTROCHEMICAL SOCIETY TO HOLD APRIL MEETING IN PITTSBURGH

THE 83RD MEETING of the Electrochemical Society will be held in Pittsburgh April 7-10, with headquarters at the Hotel Roosevelt. Technical sessions will be held on corrosion, dielectrics, electrothermics and automatic control.

An outstanding feature of the convention will be the symposium on dielectrics. S. M. Clark, chairman of the symposium, has arranged the program and papers will be presented by foremost experts in the field. Among the companies and institutions represented are the General Electric Co., Westinghouse Research Laboratories, Massachusetts Institute of Technology and Commonwealth Edison Co. This symposium is scheduled for Friday, April 9.

AMERICAN CHEMICAL SOCIETY TO HOLD MEETING IN APRIL

A FIVE-DAY war meeting of the American Chemical Society will be held in Detroit April 12-16, with headquarters at the Statler and Book-Cadillac Hotels. Scientific sessions will be held at the Masonic Temple.

The program, including technical sessions, conferences and group discussions, will be devoted entirely to advances made by chemical science and industry in relation to the war effort. Due to the present situation, the Society's board of directors has banned trips to industrial plants as well as social events.

Fifteen of the Society's professional divisions will meet to discuss substitutes for agricultural and food commodities, stabilization of fats, high-protein foods, solvents in war industries, and other topics of wartime importance. Five sessions will be sponsored by the Division of Industrial and Engineering Chemistry, of which Professor R. Norris Shreve of Purdue University is chairman. The Division of Rubber Chemistry will hold four sessions.

AMERICAN CERAMIC SOCIETY PLANS ANNUAL MEETING FOR APRIL

THE WAR CONGRESS or 45th annual meeting of the American Ceramic Society will be held at the William Penn Hotel, Pittsburgh, Pa., during the week of April 18, it has just been announced. Programs for the General Sessions are being developed satisfactorily and will include a number of important speakers. Douglas Whitlock of the Structural Clay Products Institute will report on the War Council of that Institute. The Institute is preparing a report on the "Role of Ceramic Engineers in the War Effort," by N. W. Taylor. Division sessions will probably be held Tuesday afternoon and Wednesday.

Dr. Norman L. Bowen of the University of Chicago will deliver the Edward Orton, Jr. fellowship lecture on Monday afternoon on the subject of "Petrology and Silicate Technology." The Local Committee is planning a reception for Sunday night following an illustrated lecture and demonstration by Alexander Silverman on "Postwar Glasses." Monday night will be devoted to alumni reunion and student receptions.

WARTIME PACKAGES EXPOSITION TO BE HELD IN NEW YORK

THE EXTENT to which packaging, packing and shipping industries have indicated their activities in the war effort will be highlighted at the Wartime Packages Conference and Exposition, to be held at the Astor Hotel, New York, N. Y. April 13-16. Reports from the exhibitors received by the American Management Association, sponsor of the conference, indicate that the exhibits will be concerned exclusively with presentation of products and services for war and essential civilian needs.

A special exhibit of war packages and packings and shipping methods by various government agencies will be a feature of the exposition. The conference program will be devoted entirely to war aspects of packaging.

PAPER TECHNOLOGISTS ELECT OFFICERS

THE TECHNICAL ASSOCIATION of Pulp and Paper Industry reelected Ralph A. Hayward, president and general manager of the Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., to serve another year as president. To serve with Mr. Hayward, Vance B. Edwardes, sulphite superintendent of the International Paper Co., Palmer, N. Y. was reelected vice president.

Albert Bachmann, vice president of the Missisguoi Paper Co., Sheldon Springs, Vt., J. E. Malcolmson, technical director of the Robert Gair Co., Inc., New York, Paul Hodges, assistant general manager of the Crossett Paper Mills, Crossett, Ark., and A. E. Montgomery, vice president and western manager of J. O. Ross Engineering Corp., Chicago, Ill., were elected to serve three years on the Executive Committee. R. G. Macdonald is secretary-treasurer of the Association, with headquarters at 122 E. 42nd Street, New York, N. Y.

MIDWEST POWER CONFERENCE SCHEDULED FOR APRIL

THE 1943 MIDWEST Power Conference will be held Thursday and Friday, April 8 and 9, at the Palmer House in Chicago. This will be the 17th annual meeting of the Conference and its sixth under its present sponsorship. General subjects now planned as topics for discussion sessions include: central station practice, electrical distribution, diesel power, fuels and combustion, and industrial power plants and their protection and maintenance. Thirteen speeches on these subjects are listed in the preliminary program.

Speakers at the 1943 Midwest Power Conference will be C. W. Kellogg, president of the Edison Electric Institute in New York, who will give the keynote address on "Electric Power Supply."

CALENDAR

APRIL 7-10	The Electrochemical Society, 83rd meeting, Hotel Roosevelt, Pittsburgh, Penna.
APRIL 9-10	Midwest Power Conference, Palmer House, Chicago, Ill.
APRIL 12-16	American Chemical Society, 105th meeting, Statler and Book-Cadillac Hotels, Detroit, Mich.
APRIL 13-16	Packaging Exposition and Wartime Container Conference, Hotel Astor, New York, N. Y.
MAY 10-11	American Institute of Chemical Engineers, 35th semi-annual meeting, Waldorf-Astoria Hotel, New York, N. Y.

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Zero ± 0 Accuracy

Send for this brief if you are considering the adoption of electronic control. It contains a simple explanation, a technical description of the circuit and suggested applications of the Hurley Electronic Control.

● This company invites correspondence from manufacturers who are interested in discussing a license arrangement for the use, or application, of the Hurley Electronic Control to the solution of any control problem.

The Hurley Electronic Control will maintain any pre-determined value with accuracy to Zero ± 0. It is not an "electric eye," though a photo-electric cell may be employed in the control layout if conditions suggest the desirability of its use.

The operation of the Hurley Electronic Control is distinctly different. It has been in the development stage for ten years. It has proved itself commercially in certain industries for over seven years. Now, as the result of further research and experimentation, it is available for application in a wide range of industries—public utilities, electrical manufacturing, processing of all kinds, metal working, combustion control and steam utilization, weighing, testing, inspection, and other production line control. A complete list is too long to include here.

If you are interested in electronics, either from the viewpoint of product design or production improvement, write us. We will discuss the subject at your convenience, and tell you quite frankly if the Hurley Electronic Control is practical for your purpose. Send for the brief, illustrated above, as a preliminary to such discussions.

If you are not interested in securing a license under the Hurley patents, you may be interested in discussing the application of Hurley Electronic Control to your general production problems on a consulting engineering basis.

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In addition, one session of the program already looms as unique in the Council annals. It is that of plant protection, conducted by an all-army personnel. Lt.-Col. A. G. Coulson and Maj. Ralph W. Applegate of the 6th Service Command will be the speakers with the topics of "Wartime Protection of Power Plants" and "Accident Prevention in Public Utilities." H. H. Gorrie, design engineer with the Bailey Meter Co. of Cleveland will speak on "Use of Automatic Controls to Increase Plant Capacity" and A. C. Foster, manager, service department of Foster Wheeler Corp., in New York will speak on "Boiler Maintenance Under Wartime Conditions." Philip W. Swain, editor of *Power*, New York, will speak on "Practical Education in Wartime."

A.S.T.E. TO SPONSOR EXHIBITION IN MARCH

As THE RESULT of demands from industry, the American Society of Tool Engineers has reversed its previous decision and has authorized holding of a 1943 Machine and Tool Progress Exhibition in connection with the Society's annual meeting in Milwaukee, March 25-27. A sizeable portion of space is reserved for government exhibits of interest to contractors and sub-contractors.

The 1943 annual meeting of the A.S.T.E., being held concurrently with the Show, will feature six technical sessions. These will be in the form of symposia on such subjects as "Women in Machine Shops," "Increasing Tool Life," "Tool Salvage," "Machining of N. E. Steels."

SELECTIONS FROM CONVENTION PAPERS

IMPROVEMENTS IN CONTINUOUS MULTI-STAGE WASHING

THE PRESENT American pulp market permits a fair margin of profit, but with the end of the war will come the necessity of rigid economies in order to hold our share of business. Reduction of soda consumption is an important method of cutting costs. Loss of soda occurs through three departments: causticizing, recovery and wash room. Modern continuous causticizing systems, together with lime kilns, have practically eliminated both soda and lime waste.

Better furnace operation and electrical precipitators have cut down consumption of soda materially. Improved wash room operation has resulted in real progress, but there is opportunity for further savings in this department, although salt cake make-up requirements fifteen years ago were 350-400 lb. per ton and are now only 200-300 lb. In one or two mills it is below 200 lb.

We are warranted in studying the washing problem with the ultimate goal of reducing loss in the soda mills to 10 lb., in a bleached sulphate mill to 15 lb., and in a board mill to 20 lb. per ton. The conclusion is that by use of the best methods the pulp can be washed clean, which is the primary purpose of the washers. Improvement in the wash room, together with those already made in the causticizing and recovery departments, will lower salt cake consumption to 150 lb. and result in cleaner pulp.

J. P. Rich and J. H. Noble before the Technical Association of the Pulp & Paper Industry, 28th annual meeting, New York, N. Y., Feb. 15–18, 1943.

DIATOMACEOUS SILICA IN PATENT COATED LINER AND LINER STOCK

DIATOMACEOUS silica is proving of interest to producers of white patent coated board, and is now being included in the stock going to make up the liner on the basis of approximately 5 percent of the weight of the pulp. Over long-term operations, diatomaceous silica has proven of value to the board manufacturer because it has eliminated the frequent tendency of stocks of this type to form high and low spots in the sheet, and at the same time has increased the caliper of the liner and the ease with which the drying of the sheet can be obtained.

Presence of the diatomaceous silica does definitely contribute to better formation, higher brightness and opacity of the liner, and an increase in operating efficiency.

Much interest has been shown in the use of diatomaceous silica to assist the deinking of fibre going to make up a percentage of the above furnishes. It is generally agreed that diatomaceous silica, being distributed evenly throughout the mass of pulp fibres, acts mechanically to aid the water and chemicals in removing the ink. It is also thought that absorption qualities of the diatomaceous silica keeps the ink from agglomerating and prevents redepositing.

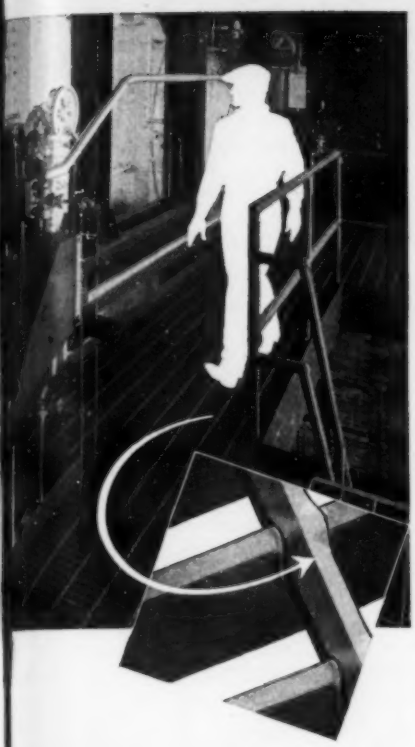
Stock is deinked more thoroughly and more readily, and the final washed pulp has a uniformly higher brightness more nearly approximating its natural color than was obtained in mills when diatomaceous silica was not used in the deinking process.

W. R. Monette, before the 28th annual meeting of Technical Association of the Pulp & Paper Industry, New York, N. Y., Feb. 15–18, 1942.

HEAT, MASS AND MOMENTUM TRANSFER IN FLOW OF GASES THROUGH GRANULAR SOLIDS

DURING THE constant rate period in through-circulation drying of granular solids, all the resistance to mass transfer, energy transfer and momentum transfer resides solely in the gas phase. This situation provides a general and reliable method of obtaining the transfer properties of gas films in gases flowing through granular materials and divorced from the transfer resistances of other phases which may be present.

Heat and mass transfer factors for gases flowing through granular beds have been obtained and plotted against the modified Reynolds number $\frac{D_p G}{\mu}$



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That scraper edge on the Bates open steel flooring cross bar is cleaner and safer. You grasp the idea from even a quick glance at the picture. Yet it doesn't cost you a cent more.

You get those extra advantages because the Bates patented process builds a fillet from displaced metal—in addition to the clean scraper tread of the "Hex" cross bar, giving you smoother, cleaner, larger welds *and stronger flooring.*

The whole process is explained—and many fine installations pictured—in the 8½ x 11 catalog, "FILLET-WELD BATES GRATES." Write for a copy.

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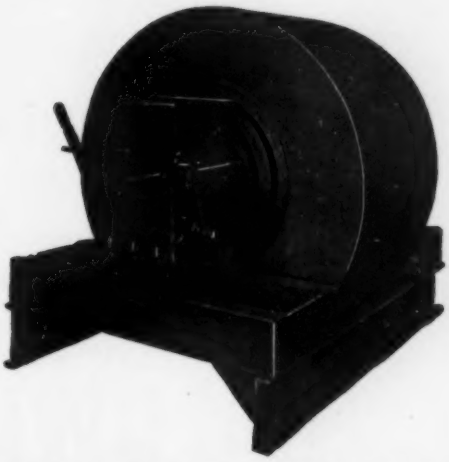
IT'S THE TRIPLE BLEND ACTION OF THE STURTEVANT THAT GIVES SUCH



PERFECT DRY BLENDING

No matter what the weights, densities, sizes, fineness or consistencies, you'll get satisfaction the "triple blend" way!

Dustless! No Separation!

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Delivers weighed, assembled substances into large drum, while slowly rotating. Material is picked up by revolving buckets, carried to top of blending chamber, thrown into stream of incoming feed. This, plus revolving action, is ideal blending. Materials are forced from both sides to middle of drum, adding a *third* blending action with no separating effect. Light substances do not float and remain unblended. Scientificially blends materials, 1st, to definite chemical analysis; 2nd, various sizes together; 3rd, colors to a precise exactness. Leak-proof because dustless construction. No internal moving parts to break down original composition of material! Intake and discharge through same opening.

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STURTEVANT AIR SEPARATORS

. . . for removing fine (dust) particles from materials milled or in their natural state 25% to 300% increased mill capacity . . . 10 to 50% lower power consumption. Cover range from 40 to 400 mesh. Capacities almost unlimited. Send details of your problem . . . we will gladly make recommendations.

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Cannot Soak

White wool in water saturates and sinks. B-H bobs water-free to the surface.

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BLACK ROCK-WOOL INSULATIONS

MOISTURE does not disintegrate this utterly different form of rock wool. It does not make it settle. It can't ruin its insulating value. By actual test, B-H black rock-wool absorbs less than 1% of its weight in moisture after being immersed completely.

That is one reason for specifying B-H black rock-wool. Another—equally important—is its stability under heat and vibration. 1400° of flame, which cut their way right through ordinary white rock-wools, leave B-H unharmed. Remember these facts and investigate B-H black rock-wools, felts, blocks and cements.

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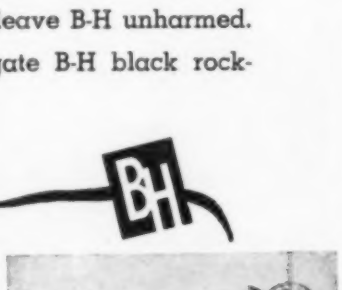
A generous sample square of Baldwin-Hill Mono-Block, the one block for all temperatures up to 1600°, together with a sample of B-H Bond-Tite, the easy adhesive which makes wiring unnecessary. Test for yourself the heat-resistance, the extraordinarily low conductivity, the quick adhesion, and ease of cutting of this universal insulation. Just write us on your letterhead.



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All data fall on a single line within an accuracy of ± 3.5 percent for both spheres and cylinders, covering the experimental range of diameters, viscosities, densities, mass velocities, temperatures and humidities. The liminar flow region covers values of $\frac{D_p G}{\mu}$ below 40 and the turbulent region values above 350.

The range of variables includes spheres and cylinders, with diameters ranging from 0.09-0.456 in. for spheres, 0.161-0.740 for short cylinders, thus covering the size of catalyst carriers used in stationary beds; dry bulb temperatures from 80-160 deg.F.; wet bulb temperatures from 60-125 deg.F.; mass velocities from 400-2,300 lb. per hour per sq.ft.; and corresponding variations in humidities, viscosities, diffusivities and densities.

Values of the dimensionless groups $a(HTU)_h$, $a(HTU)_d$, j_h and j_d are plotted as functions of the modified Reynolds number for the ranges of Schmidt and Prandtl numbers usually encountered.

Friction factors for pressure drop were found to be dependent upon shape, wetness of surface and interstitial configuration. Friction factors are much more sensitive to the nature of the bed, its compactness and arrangement, than are mass and heat transfer factors.

Bernard Gramson, George Thodos, and O. A. Hougen, Chemical Engineering Department, University of Wisconsin, Madison, Wis., before the American Institute of Chemical Engineers, Cincinnati, Ohio, Nov. 16–18, 1942.

THE CHEMICAL PROFESSION AND THE WA

MODERN WARFARE requires weapons with tremendously increased fire power and mobility and large quantities of explosives, as well as liquid and solid fuels. Although most of the explosives now used have been known for some years, a major chemical engineering problem was involved in expanding manufacturing facilities to supply the unprecedented demands of our armed forces and those of the United Nations.

At the start of this war, even with greatly expanded chemical production, serious shortages of raw materials in several commodities were encountered. Synthetic ammonia, phenol and toluene plants of great capacities have been rapidly built. The output of American explosives plants, approaching a maximum in the next few months, staggers the imagination.

Probably the greatest and most urgent assignment in this war is development of an industry to produce one million tons of synthetic rubber per year. It is with confidence in its chemists and chemical engineers that the country looks ahead to a supply of synthetic rubber for war requirements, and to the establishment of an industry expected to continue operation following the ending of hostilities.

Strategic importance of chemical personnel can be visualized by imagining the effect of removing chemists from the Division of Health in a large industria

city or the induction of chemists in charge of water purification plants. In the food industries, an increasing number of problems in connection with quick freezing, dehydration, vitamin production and food enrichment make it essential to the welfare of the entire nation that trained chemical personnel stay in their industrial jobs. Chemists and chemical engineers are essential in peace as well as indispensable in war. When the story of this war is written, the achievements of the American chemical profession and the chemical industry will be recognized as outstanding.

When statistics on chemical manpower are examined, it is shocking to find the remarkable chemical activities in this country are the result of the ingenuity and supervision of a very minute fraction of the entire population. Only one person out of every 2,000 people in this country is a trained chemist or chemical engineer, whereas estimates indicate that Germany has a ratio of three chemically trained people to every 2,000 persons.

A large majority of our chemical manpower are young men liable to conscription under Selective Service. Most chemists and chemical engineers completed their education since the first World War. Many Selective Service Boards have inducted chemical personnel or have caused so much annoyance and uncertainty that increasing numbers have been entering the armed forces. Very few of these men make use of their special chemical abilities in the fighting services. Chemists and chemical engineers require a normal training period of from 4-7 years, and even in wartime this cannot be condensed to less than three calendar years. To train a soldier requires only from 6-12 months.

At present, about one-half of all chemistry and chemical engineering students are taken by the armed forces, due to enlistment in Reserve Corps or R.O.T.C. units. This percentage will approach 100 percent unless some definite chemical manpower plan is advanced. This means that industry cannot expect replacements from the colleges unless some drastic change in policy occurs.

C. F. Prutton, Case School of Applied Science at the Alpha Chi Sigma Founders' Day Banquet, sponsored jointly by Cleveland and Akron Professional Chapters and Case Collegiate Chapter in Cleveland, Ohio, Dec. 4, 1942.

THE MILLING INDUSTRY AND NATIONAL NUTRITION

Since 1910 wheat acreage in the United States has increased approximately 21 percent. During the same period, population has increased but slightly in excess of 12 percent. To complicate the economic structure, the per capita consumption of flour has decreased in this country from roughly 225 lb. in 1900 to 156 lb. at the present.

This brings up the question of vitamins which would normally be supplied in bread. The present importance of the vitamin industry is shown by the fact that the pharmaceutical trade sold more than 75 million dollars of vitamin preparations during the last 12 months. Whole wheat grain is an excellent

The patented, exclusive Kemp Industrial Carburetor, the machine that provides *complete* premixing of gas and air for complete combustion so that no secondary air is entrained at the burner, is solving problems and saving money in industrial chemistry.

The Industrial Carburetor is putting fast, economical gas heat *inside of solutions* instead of outside of the pot, provides efficient heat safely where open flames can not be used, supplies fuel to the economical, fully automatic Kemp Inert Gas Producer.

With the Industrial Carburetor, fuel savings over other heating equipment are normally from 15 to 40 percent, frequently higher. For engineering details and assistance address

The Army-Navy "E" flag, awarded "for high achievement in the production of materials of war," proudly flies at The C. M. Kemp Mfg. Co.

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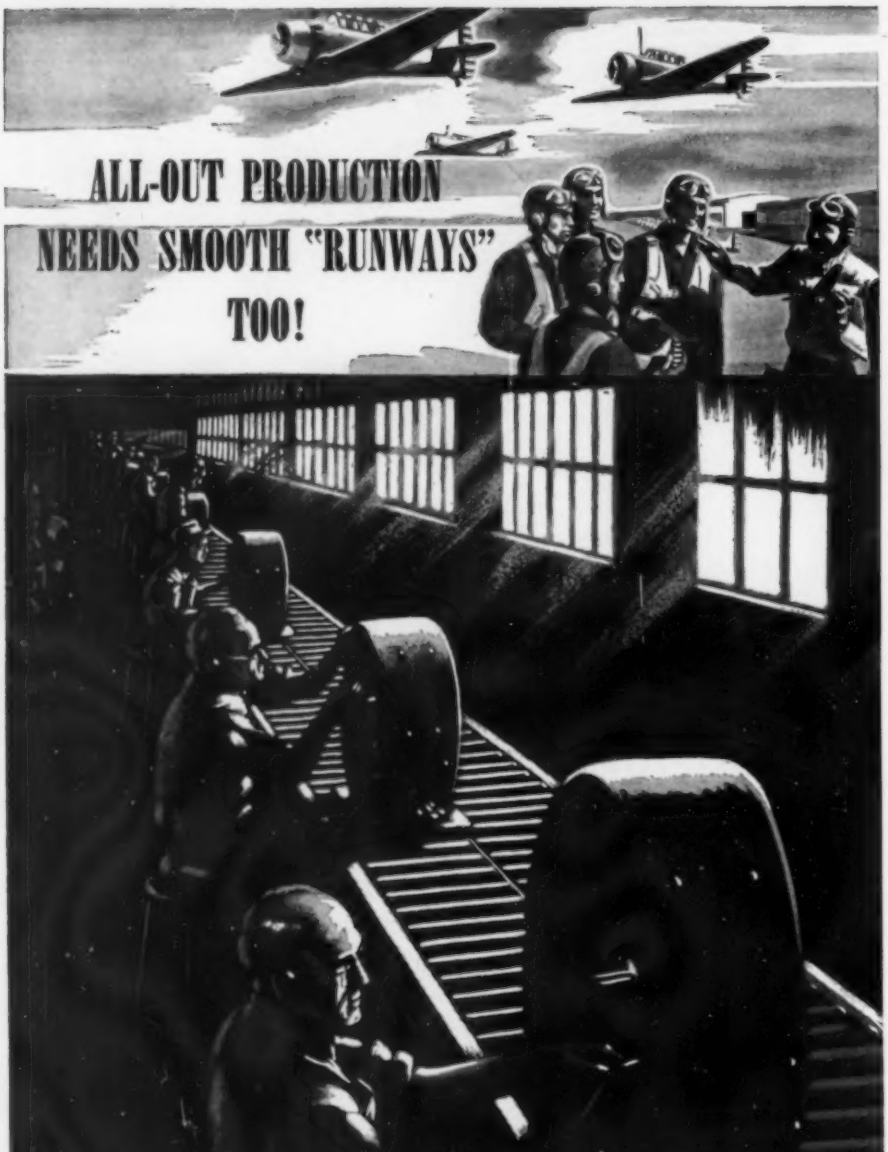
KEMP of BALTIMORE



Many of America's great manufacturers who are beating their schedules — know and rely on Standard Conveyors for a smooth, uninterrupted flow of work in process. Standard Conveyor engineers have helped them to streamline their handling methods—to keep production synchronized — to utilize every square foot of working space more effectively—to make man-hours count more in increased production.

Standard power or gravity conveyors can provide fast, smooth "runways" for your output through all steps in manufacturing. Send for the 84-page "Standard" booklet CM-3 showing conveyor applications and possibilities in a wide range of industries.

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STANDARD
Gravity and Power
CONVEYORS

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and cheap source of Vitamin B_1. It is also reasonably rich in iron, phosphorus, and Niacin, but a relatively poor source of Vitamin B_2 or Vitamin G. Vitamin B_1 is now considered the most important single element to our existence. It is definitely one substance for which there is no substitute. It is essential for normal growth and for the metabolism of carbohydrates. It has pronounced control over the nervous system, as well as effecting digestive disorders. It has a tremendous influence in limiting fatigue and in influencing the individual's moodiness and morale. It also affects our appetite.

Normally, this vitamin together with Niacin and certain minerals, would be supplied in large measures by 100 percent whole wheat bread. However, the consuming public prefers white flour and white bread. Only 2 percent of the 100 million bbl. of flour produced annually in this country is whole wheat flour, and only a fraction of even this is converted into 100 percent whole wheat bread.

In February, 1941, the Committee on Foods and Nutrition of the National Research Council recommended that a new type of flour and bread should be made available to the public to be known as "enriched" flour and "enriched" bread. Standards for this bread were to contain not less than 1.0 mg. of thiamin chloride, 4.0 mg. of Niacin and 4.0 mg. of iron per lb. The "enriched" flours already on the market usually contain not less than 1.66 mg. of thiamin chloride, 6.15 mg. of Niacin and 6.15 mg. of iron per lb. Enriched flour thus carries approximately 80 percent of the more important vitamin levels of whole wheat flour. The nutritional levels of enriched flour and enriched bread will probably be increased to the natural 100 percent whole wheat level as the availability of synthetic thiamin chloride and riboflavin, or B_2, increases.

Cost of securing increased essential vitamins and minerals in the system through proper food selection as compared with pharmaceutical methods is strikingly illustrated through the use of enriched flour and enriched bread. It now costs approximately 0.1 cent per lb. to produce enriched flour and 1/15th cent per loaf to produce enriched bread. In other words, all the flour and bread consumed in this country can be enriched for about 20 cents per person per year.

Average daily per capita consumption of flour is 6.5 oz. Accordingly, if our present white flour could be lifted to the B_1 level of 100 percent whole wheat flour, a full 50 percent of our B_1 requirement would be automatically and unconsciously secured.

All flour, bread and cereals used by the armed forces of the United States are of the enriched type. Both England and Canada are following a somewhat similar program of improved nutrition. However, there are no government regulations limiting production of flour, cereals or bread for civilian usage to the enriched varieties, but certain states have only recently passed such legislation. All flour and bread now offered

for sale in both South Carolina and Louisiana must be enriched and it is expected that similar legislation will be passed soon in Kentucky, Georgia, Mississippi, Texas and probably Pennsylvania.

At the present time, between 60-65 percent of the family flour produced in this country is enriched and at least 75 percent of the white bread produced by the larger bakers is enriched. This progress has all been made since March 7, 1941.

R. S. Herman, vice president of the Eastern and Central Divisions of Washburn Crosby Co., before the Western New York Section of the American Chemical Society, Niagara Falls, N. Y., Oct. 13, 1942.

THE DRYING OF RAYON

THIS PAPER represents experimental data on the effect of various conditions as temperature, humidity, and air velocity (1) upon the chemical engineering aspects of the drying of 150 denier, 40 filament viscose rayon yarn in skein form and made by the "Spool Process" and (2) on certain properties of the yarn. It describes construction details on the experimental dryer, which was 20 ft. long, 8 ft. high. The ductwork in all parts except the humidifying and heating section was 2 sq.ft. cross section.

Results of the work indicated that the rate of drying of this rayon yarn, previously centrifuged, and under the conditions investigated was found to conform to the particular equation:

$$-\frac{dW}{d\theta} = 0.78\, G^{1.41}\, (\Delta H)\, W$$

Where, $dW/d\theta$ = rate of drying, lb. of water evaporated per hr. per lb. of bone dry stock; G = mass velocity of air lb. per min. per sq.ft.; ΔH = saturation humidity corresponding to the wet bulb temperature of the air—humidity of the air, lb. water per lb. bone dry air; w = free moisture content, lb. water per lb. bone dry stock.

No constant rate period was observed in the drying of rayon skeins which had been sufficiently centrifuged to eliminate excess water. The equation therefore represented only the falling rate period of the normal commercial rayon drying conditions.

Drying conditions in the ranges investigated from room temperature to 200 deg.F., percentage humidity from 2-40 percent, and air velocity from 20-50 lb. per sq.ft. per min. caused no observable rayon degradation as shown by the determination of wet tensile strength, elongation, copper number, and cuprammonium disperce viscosity.

Work on this phase of the problem presents data on the drying of 150 denier, 40 filament rayon cakes made by the "Viscose Pot Process." The investigation was carried out in the experimental dryer described. The same conditions were varied. One of the purposes of this investigation was to establish if possible (1) optimum conditions for the drying of rayon cakes, and (2) to correlate the mechanism of moisture flow within the cakes with the general external drying conditions, therefore moisture, temperature gradients were meas-

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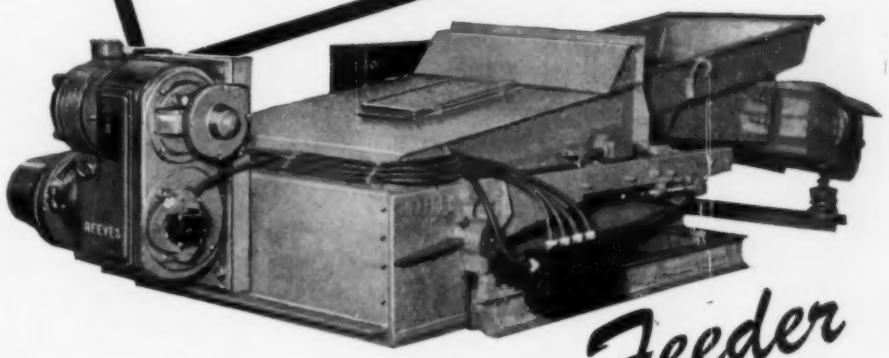

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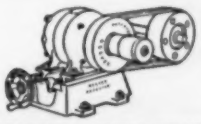

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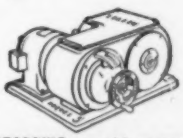

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ured during the drying operation. The electrical resistance of the rayon cake was found to vary with the moisture content of the cakes, and an instrument for measuring this resistance and calibrated to moisture percent was built and used.

A different equation of the same type

$$\frac{-dW}{d\theta} = 0.88\, G^{0.5}\, (\Delta H)\, W$$

was found to hold to represent the rate of drying of the cakes.

Moisture gradient charts indicated a non-uniform gradient during drying and suggested internal drying stresses as another factor influencing moisture flow in rayon cakes during drying.

Here again drying air temperature, humidity, and air velocity had no noticeable effect on the copper number, wet tensile strength elongation, and cuprammonium disperse viscosity of the dried yarn.

Howard P. Simons, West Virginia University, Morgantown, W. Va., Richard J. Mitchell, Engineers Corp., United States Army, Joseph H. Koffolt, and James E. Withrow, Ohio State University, Columbus, Ohio, before the American Institute of Chemical Engineers, Cincinnati, Ohio, Nov. 16–18, 1942.

WARTIME CHEMICALS FROM NATURAL GAS

FOR MANY years natural gas has been used mainly for heating and generation of steam and electrical power. In the last few years, however, research has developed a much higher field of utilization in the conversion of the hydrocarbons into superior aviation gasolines, lubricants, synthetic rubber, explosives, acetylene, etc.

Buses, trucks, tractors, and power shovels totaling over 25,000 in the United States, use compressed propane and butane. One truck company has liquefied butane functioning in a dual role as a refrigerant for fruits and meats and as motor fuel for the truck after the cooling has taken place.

Uses for propane which have gained wide commercial application are as refrigerants and solvents in the refining of lubricating oils. Over 50 percent of the world's lubricating oils are improved in quality by the use of propane.

Out of the total 886,000 tons of synthetic rubber planned for the United States, 705,000 tons of it will come from butadiene and styrene. The normal butane that will be used for butadiene will represent about 80,000 tons a year, derived largely from natural gas.

Natural gas or products therefrom under high pressure conditions yield acetylene readily. It is believed that acetylene can be produced at a lower cost from processing natural gas than by the electro-chemical method of producing calcium carbide.

It is interesting to learn at this time that some trucks using synthetic rubber tires have gone over 35,000 miles. Side wall tire strength is greater, meaning greater safety and better road gripping ability. The latter property has been tested out thoroughly on wet and muddy roads. Tests on hills have shown that the synthetic rubber-tired vehicle goes

up a hill with little side-slipping, whereas the tires of natural rubber slipped all over the road. On curves when operating the car at high speed, the synthetic tire is safer than the natural. Synthetic rubber in mass production will soon undoubtedly cost less than 15 cents a pound.

In World War I the maximum toluene production was at the rate of 15,000,000 gal. a year and practically all came from coal carbonization plants. Toluene production in World War II from coal carbonization is at the rate of over 25,000,000 gal. a year, but the demand is 250-300 million gal. a year. The difference between these figures will represent toluene derived from petroleum sources.

Nitroparaffins from natural gas may well develop into one of the newer and valuable sources of high explosives. Methane gas, when nitrated, produces tetranitromethane. This compound is the most destructive explosive known to man. Unfortunately, no commercial process has been worked out to make this product available for use by our armed forces.

Ethylene has been shown to have properties superior to those of ether and nitrous oxide as an anesthetic. Cyclopropane was still a laboratory curiosity until the end of 1930 when it was first applied in human anesthetics. It has been widely adopted since as being one of the safest anesthetics.

Olefins have been investigated as fruit ripening agents and for use in inducing accelerated plant growth. The first gas to be utilized for this purpose was ethylene.

Methyl methacrylate resins are used as the transparent non-shatterable parts in airplanes. The same resins will undoubtedly be used by the automobile industry after the war is over. A high degree of visibility from all over the motor car will be worked into the new design requiring less supporting framework, and a clear vision rooftop with sliding window will undoubtedly take the place of present designs.

Gustav Egloff, director of research, Universal Oil Products Co., Chicago, Ill., before the American Institute of Chemists, New York, N. Y., Oct. 23, 1942.

FISHER TO DISCUSS SYNTHETIC RUBBERS BEFORE J.C.E.

Dr. HARRY L. FISHER, director of Organic Research, U. S. Industrial Chemicals, Inc. and Air Reduction Co., Stamford, Conn., will discuss the subject "Synthetic Rubber: Its Present and Probable Future" at the March 18 meeting of the Junior Chemical Engineers of New York. The meeting will be held at 29 West 42nd St., New York, at 8:00 p.m. The dinner preceding Dr. Fisher's talk will begin promptly at 7:00 p.m. Visitors are invited to attend.

Dr. Fisher, once professor of organic chemistry at Columbia University, has had seventeen years of experience with rubber concerns in this country. He was recipient of the Modern Pioneer Award in 1940 and in 1941 he delivered the honorary Edgar Marburg lecture before the A.S.T.M. He is past president of the American Institute of Chemists.

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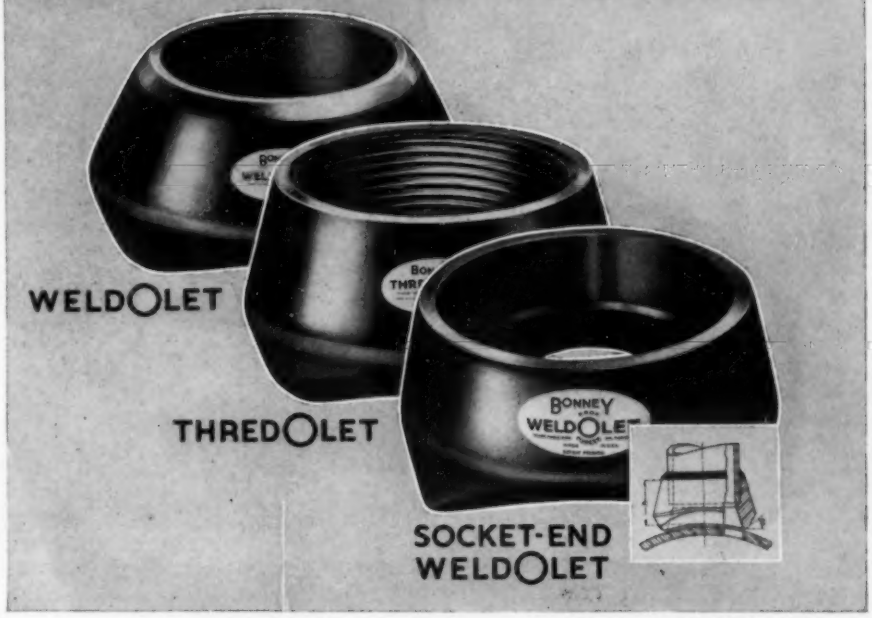

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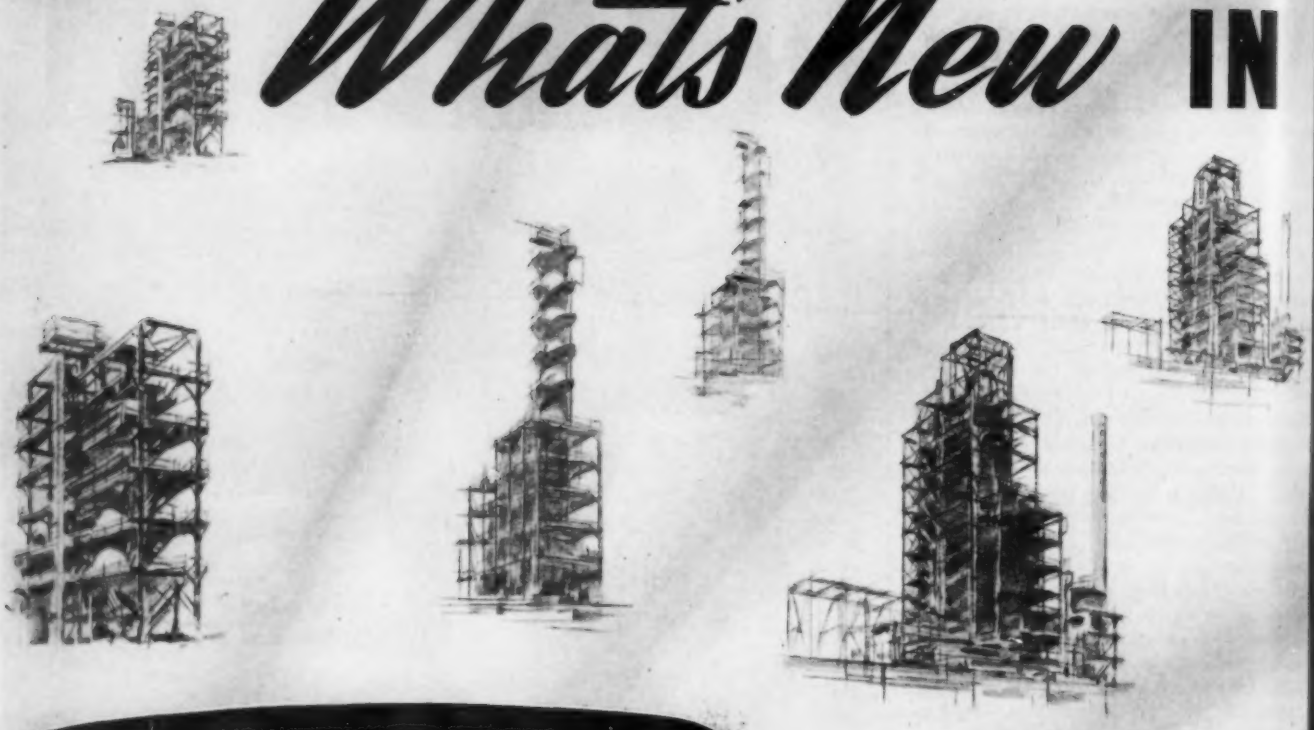

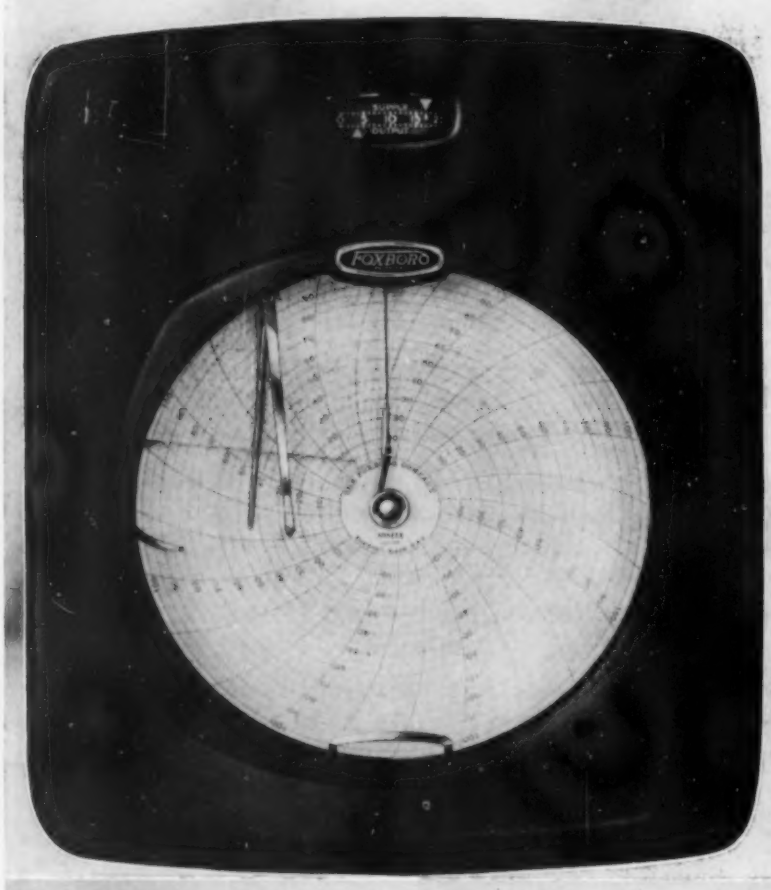

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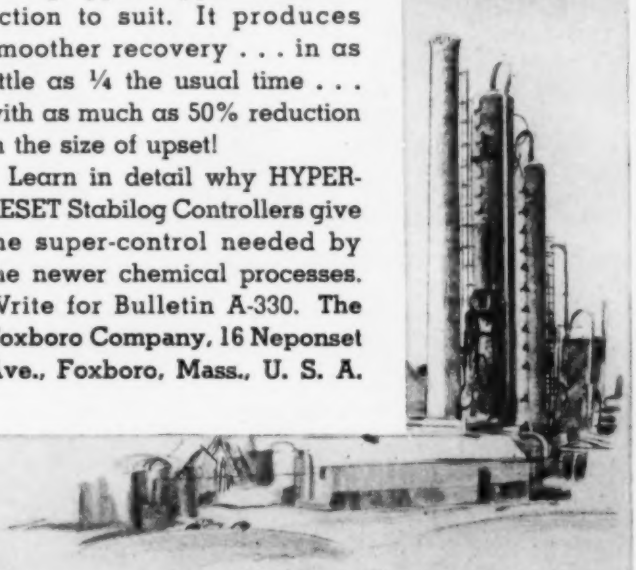

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NEWS FROM ABROAD

GREAT BRITAIN PLANS TO EXPAND ELECTROCHEMICAL INDUSTRIES IN POST-WAR PERIOD

Special Correspondence

While an increasingly large part of the output of chemicals is used for war purposes, plans are being worked out for the establishment of new chemical industries after the war, when some of the gaps laid open by the war will be filled. The dependence upon foreign supplies for a large part of the British demand for electrochemical and electrometallurgical products has been felt to be a great drawback in recent years, and rapid progress in this field is therefore anticipated. A committee appointed last October to investigate the possibility of setting up industries on the basis of hydroelectric power in the highlands of Scotland has published its report, and its recommendations have been accepted by the Government. It is proposed to form a new public service corporation, the North Scotland Hydro-Electric Board, to be responsible for initiating and developing all further electric power for public supply in the Scottish highlands.

Through the offer of cheap and abundant power it is hoped to attract to the highlands a share in the electrochemical and electrometallurgical industries, to develop on an experimental and demonstrational basis, isolated schemes in isolated districts, and to develop a surplus production for sale via grid to other regions. The expansion of the electrochemical and electrometallurgical industries is no doubt the most important outlet for additional hydroelectric power. Not only was British production in this field short of the country's requirements before the war, but these industries are bound to undergo further expansion. Hitherto these British industries relied on a variety of power supply sources. While some use was made of water power in Scotland and Wales, coal provided a more important source of energy in most parts of the country, and a progressive policy of hydroelectric development was hindered by the opposition of quarters interested in the preservation of the general amenities of the highlands.

Calcium Carbide Production

The electrochemical industries which would be developed are largely concerned with the production of calcium carbide and its derivatives, but the chemical fertilizer industry would also profit. Among electrometallurgical industries the refining of copper, zinc, and light metals would benefit materially from cheap power supply, the more so as the cost of transport from ports of arrival for imported minerals would be comparatively low. The investigating committee came to the conclusion that only by the use of water power, additional electrometallurgical industries could be established in Great Britain. Such industries as exist in the country have a hard stand against foreign metals produced under more favorable conditions.

There is no need, however, to limit the prospective electrochemical and electrometallurgical industries to calcium carbide and cyanamide and to the refining of non-ferrous metals. The production of ferro-alloys and the manufacture of graphite electrodes will provide other outlets for water power. The electrolysis of water for the production of 100 percent hydrogen and 99.7 percent oxygen has made considerable headway. Greatly increased quantities of oxygen are required for metal welding and cutting, while important new outlets for hydrogen exist in the margarine and soap industry, in hydrogenation, for the preparation of catalysts, and, of course, in the synthetic fertilizer industry.

Coal Processing Methods

Great importance is also being attached by British chemists to the development of new coal processing methods with a view to the more economical use of this most important of British raw materials. A Coal Research Scheme on which $4,000,000 are to be spent over the next five years has just been announced by the president of the British Coal Utilisation Research Association. The funds will be provided by the Mining Association, representing the coal industry, by the manufacturers of coal-using plant and equipment, and by the Government, which has made it a condition of its contribution that the results of the research shall be open to the whole country.

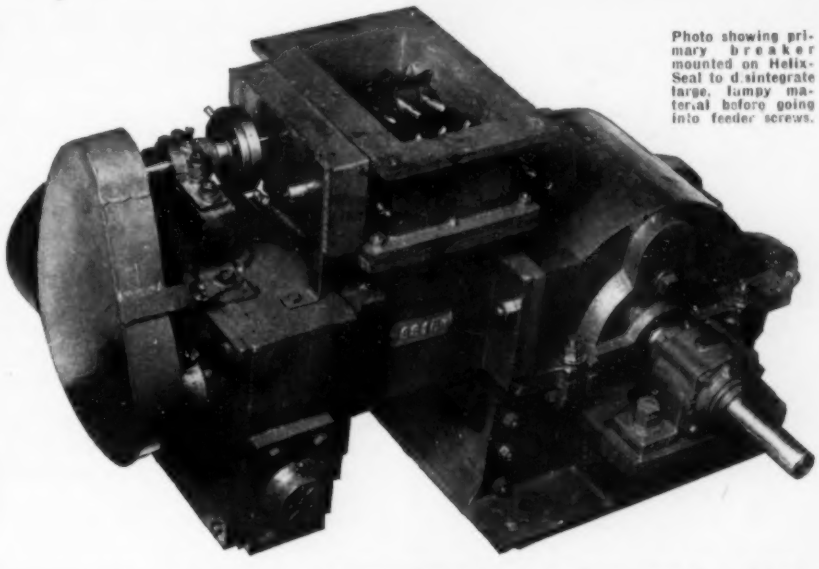
It is hoped to bring about an increase in the rate of utilization of the energy in the coal from 30 percent, the present rate, to 45 percent—an achievement which would be worth $240 million per annum. Besides, it is proposed to add to the number of useful by-products, including liquid fuel, plastics, and chemicals. It seems likely that special attention will be paid to the substitution of non-coking for coking coals in gasworks and coke-oven plants. If non-coking coals cannot be used alone, it is hoped at least to effect economies by suitable blending. Such procedure appears to be necessary if British coal exporters are to be able to compete with foreign suppliers and is also in line with present developments in Continental Europe.

Similar ideas are of importance in the research activities of other bodies. Thus the Gas Research Board reports that one of its objects is at present to examine the possibilities of a process whereby town gas of normal quality can be produced abundantly, with the maximum flexibility in the matter of the quantity of coke made and using a very much wider range of coals than can be used in existing carbonizing processes. With a view to an increase in the yield of benzol per ton of coal, the Gas Research Board has investigated the effect of cracking tar injected into the charge during carbonization in a continuous vertical retort on the output of benzol and toluene. The importance of benzol at the present time is shown by a new order which makes it compulsory for all coke producers to pass gas produced by coal carbonization through a benzol recovery plant.

Bentonite, hitherto imported from the United States for foundry work, may be replaced by British bonding clays which have been investigated by the British Cast Iron Research Association and were found to be in greater or smaller degree suitable as substitutes for bentonite. Another import article of U.S. origin which is likely to be imported into Great Britain in smaller quantities are rock-phosphates, as British needs will in future be met mainly by shipments from North Africa. It was reported immediately after the landing of Allied troops in French North Africa that phosphates would be among the products which the country could add to Allied resources. In the meantime it has been announced that, while manganese, cobalt ore, and cork will be shipped largely to the United States, North African exports of iron ore, pyrites, phosphate rock, and superphosphates will go to Great Britain. British farmers were, however, warned not to expect any larger deliveries of phosphatic fertilizers.

Metal cutters and welders have been advised to use propane or boosted coal gas rather than acetylene, for which large quantities of calcium carbide must be imported, in the cutting of metals and in non-ferrous welding. Where possible, especially when installing new plant, electric welding should be adopted, more particularly in the case of light-gage welding work. It is stated that propane can be used instead of acetylene for all purposes with the exception of welding iron and steel. Coal gas is recommended for cutting operations and for certain kinds of non-ferrous welding, but in general better results will be obtained if the gas is enriched with some other gas such as propane, methane, ether, or acetylene.

Similar methods of affecting economies by replacement of a material in short supply or dependent upon imports from overseas by another one which can be obtained in larger quantities in Great Britain are in use in several other fields. Coal tar oils are now being used on a substantial scale in order to conserve imported mineral oils. Creosote "A" can be used in most plants designed for



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Concentration of Industries

The concentration of chemical industries working mainly for the civilian market is still meeting with great difficulties, and in at least one sector, that of the paint and varnish industry, the Government has abandoned its proposal of a compulsory concentration scheme in favor of a voluntary scheme worked out and carried through by the trade itself. The difficulties experienced in this respect in Great Britain are not different from those which are bound to occur in other countries under similar conditions. Concentration naturally favors the bigger firm, which can carry out the necessary "telescoping" within its own orbit, while smaller firms may have to amalgamate with others and even to give up their identity with fatal results for post-war times. The Board of Trade, having abandoned the idea of compulsory concentration, is now prepared to issue "nucleus certificates", which entitle the holder to continue operations, on condition that by a private concentration scheme at least one works is completely closed, that there is a net release of transferable labor of at least 10 percent of the aggregate labor force or of any greater amount stipulated by the Ministry of Labour that the closing firms retain their commercial existence, and that the arrangements with the closing firms include either an adequate financial provision or arrangements for the manufacture of the products of the closing works on their account, such arrangements to be adequate to keep the closing works in a condition rendering them capable of reopening after the emergency.

In other words, it is intended not only to set free labor and plant for more important work but to make it possible for closed firms to reopen after the war. In this way it is hoped to prevent that monopolies arise as a result of wartime concentration, but it is realized that even with these safeguards the position of the small firm must become increasingly difficult if only through further restrictions on the supply of raw materials and the growing relative weight of overhead expenses.

LIMITED SUPPLY OF OILS AND FATS FORCES EUROPEAN CONSUMERS TO DEVELOP SUBSTITUTE MATERIALS

Special Correspondence

EDITOR'S NOTE: *Cut off from direct correspondence with all except a few foreign sources in neutral countries, these notes interpret recent developments in continental Europe as reported in publications and official documents received in the United States. These monthly letters, prepared in this country, will be continued only so long as pertinent material of interest to American chemical industry is available for our comment and interpretation.*

CUT OFF from overseas raw materials, continental vegetable oil processing factories are experiencing increasing difficulties. According to the most recent annual statement of the large Dutch oil and shortening concern, Van den Bergh's en Jurgen's Fabrieken, Rotterdam, its oil factories in the Netherlands are working at a fraction of capacity, and the company's chief margarine and fat factory had to be almost completely shut down the last half of the past fiscal year. The affiliated Unox factories were converted partly to manufacturing other products. Supplies of raw materials and chemicals for the soap factory of Levers's Zeen Mit. N.V. were insufficient and irregular, according to the above mentional annual report.

Although it is claimed that the Reich fat and oil position is relatively better than in the last war, shortages are admittedly acute. At a recent meeting of the Deutsche Gesellschaft fuer Fettforschung it was stated that fat chemistry still presents a number of difficult and unsolved problems. Industries are faced with the necessity of adjusting their production or processes to the curtailed supply of fats and oils.

Fats for Soap

The soap industry, the biggest consumer of technical fats, is now processing only inedible waste fats or substitutes in the Reich. The paint industry, normally the next largest consumer, it is claimed, has developed fair substitutes for formerly imported oils, but drying properties of alternate substances used in making paints and varnishes still leave much to be desired.

Only a small amount of natural fats are still being used for lubricants. In the last war when shortages of lubricants became most acute, some butter was used for lubricating purposes by Germany. The drug and cosmetic industry, with already curtailed raw material supplies, also is trying to cut down fat and oil consumption, although no great further savings are expected. Where possible, fats and oils are being replaced, for instance, by using water as a solvent and by using mineral in-

stead of vegetable or animal oils. Salves, containing no fats or even mineral oils but gelatines, colloidal salicylates or aluminum hydroxide pastes are also being introduced.

It is claimed that technically the problem of synthesizing fats has been fundamentally solved through development of paraffine oxidation. Synthetic fatty acids are being made in two or three German plants using gatsch produced in Fischer-Tropsch process synthetic gasoline plants. Experiments have been made by the Kaiser Wilhelm Institute branch at Dortmund to determine whether other fatty acids than glycerine esters, as ethyl esters, can be used for food or fodder. In experimental feeding of animals it was found that some fats produced from lower fatty acids could be absorbed and utilized by the animals. Such synthetic fats were reported to taste strongly like lamb fat. Pigs ate it readily but dogs and rats would eat it only after they had become accustomed to it.

A warning has been issued that "paraffinum liquidum" in the preparation of which oil is heated should not be used for preparing foods. Experiments with chicks have shown that the decomposition products are dangerous. Although the effect is not fully understood, it is believed the paraffine oil dissolves vitamins from the stomach and intestine contents and leads to vitamin deficiencies.

The Botanical Institute of the University of Goettingen has been studying the problem of forming fats from bacteria without using additional organic substances. Microorganisms are cultivated in Erlenmayer flasks on glass wool with a special mineral nutrient solution. In 6 months on an estimated usable surface area of 300 square meters, about 100 kg. of fat could be produced, a yield claimed to be several times higher than if oil seeds had been planted in nature in a corresponding soil area.

Iodine Substitutes

Germany's severe shortage of iodine, formerly imported almost wholly from Chile, has led to the adoption of a new process to recover iodine along with potassium chloride from blast furnace flue dust. The small amounts of iodine come chiefly from the coke. At the Heinrich-Bierwes Huette of the Mannesmann Roehren Werke in Duisburg-Huckingen four blast furnaces yield 17.5 tons of electrically precipitated flue dust per 24 hours. With an average iodine content of 0.03 percent, this is the equivalent of 5.25 kg. of water soluble iodine extractable per day. From 1,000 kg. of flue dust with an iodine content of 0.036 percent, 330 grams of iodine and 175 kg. of potassium chloride could be recovered. In normal times the process, which is fairly complicated, would be far from economical.

Reclaiming of iodine along with silver from fixing baths of photographic developing establishments is proving an important source of iodine. Other iodine-containing residues from production in

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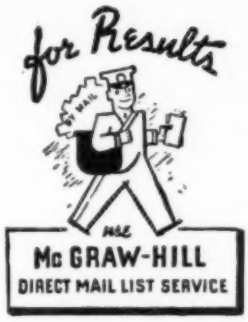

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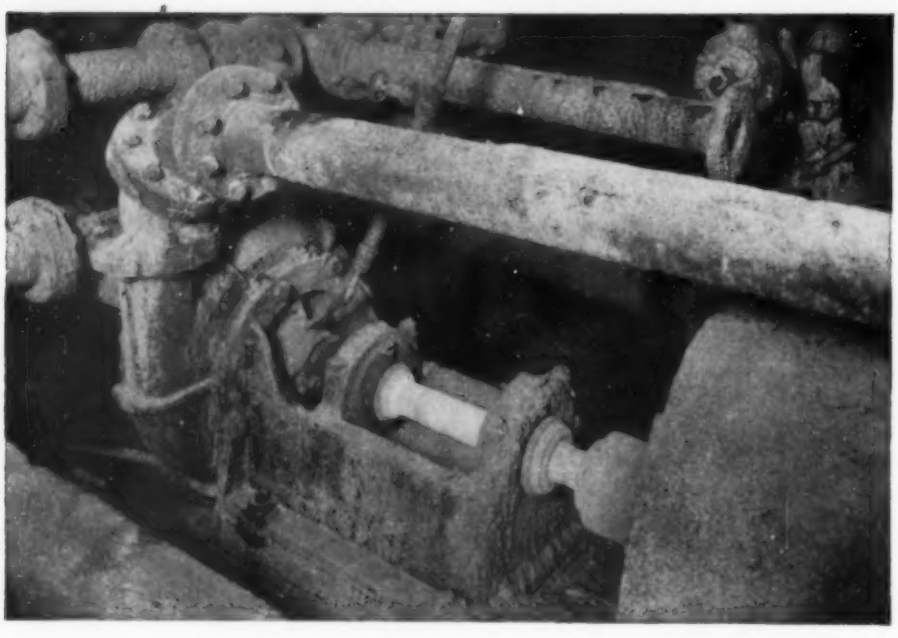

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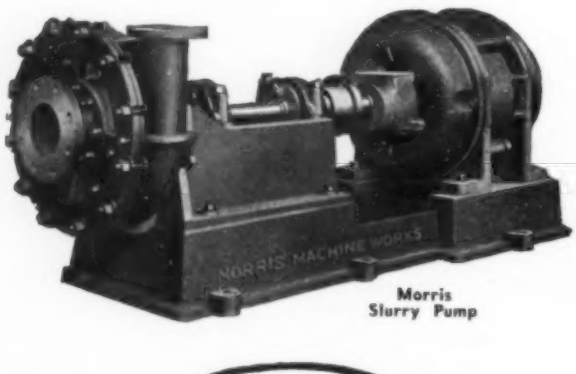

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CENTRIFUGAL PUMPS

the pharmaceutical and chemical industry are also being utilized. To replace tincture of iodine for antiseptic purposes, at least a dozen non-iodine containing substitutes, especially compounds of bromine, plentiful in Germany, are on the market. Some of these are Cumasina, Dibromol, Iodana, K-ester, Kodan, Rubefac, Sepso-tinktur (formerly known as Metaiodin), Teteform, Valvanol, and Woelm.

Kodan tincture, one of the newest substitutes, is a brown liquid, smelling somewhat like Thymol. With an alcohol solvent, it contains chlorbenzylates of alkylamides of dimethylamino-acetate, chlordimethylphenol and chloroxydiphenylmethane. The new tincture, made entirely of domestic raw materials, is claimed to equal iodine tincture in suspension tests, for instance, against staphylococcus, streptococcus, pyocaneous, anthrax, typhus, and dysentery bacillus. It does not irritate the skin, does not attack metal instruments, and contains an easily removable dye. The potency of other compounds as Dibromol and Sepso-tinktur is admittedly considerably below iodine as a fungicide.

Slag for Fertilizers

To prepare marginal soils for possible later cultivation or to counteract the so-called "Heidemoorkrankheit," a soil deficiency in moorlands which can be partly overcome with the application of copper compounds, the Norddeutsche Affinerie of Hamburg has been experimentally applying its copper slag. The slag of this refinery, the largest copper smelter on the continent, formerly was either made into paving stones or dumped on waste slag heaps. The slag consists chiefly of SiO_2 and Fe, 0.413 percent copper, and small amounts of Mn, Mo, CaO, As, and Pb. As a result of two-year experiments the company claims that as a secondary fertilizer material, 900 kg. of its slag per hectare is as effective as 50 kg. of $CuSo_4 5H_2O$, in overcoming the above-mentioned soil deficiencies. The motivation is twofold: first, to dispose of a waste product, and second to save scarce copper sulphate.

Basic slag, a byproduct of the iron and steel industry, has assumed an unusual importance as a primary fertilizer material, especially since the continent has been cut off from North African phosphate rock. Even before the war two-thirds of the phosphates used in Germany were obtained in the form of Thomas meal, a byproduct of the western German, Belgian, and French iron and steel industry. Since the consumption requirements for phosphorus, or phosphates, for making matches and soap and for softening water were comparatively small, the bulk of this phosphate was used as a fertilizer and soil conditioner. Then as well as now phosphates represented the most serious fertilizer deficiency in Germany.

The high phosphorous content of iron ores processed in the Reich, coupled with the lack of natural phosphate rock deposits, has stimulated the recovery of phosphates in the steel industry. The byproduct is valuable enough that small

amounts of natural phosphate rock are often added to the blast furnace ore and coke charge to bring the phosphorus content up to the desired 1.3 to 2 percent. Although most of the basic slag is produced in basic Thomas converters with lime being added to bind the P_2O_5 basic Siemens-Martin furnaces can also be used.

Among the most successful byproduct phosphate fertilizer types developed before the war was the so-called "Rhenania" phosphate. A new fertilizer, large-scale development of which has been postponed until after the war, is the "Roechling" phosphate developed by the Saar iron and steel concern of that name. Soda slag obtained by the addition of soda ash to desulphurize low grade ores in making pig iron is processed thermally with natural phosphate rock to make a fertilizer, which is said to be quite soluble and readily absorbed by plants.

NEW CHEMICAL INDUSTRIES IN SOUTHERN IRELAND

Conditions caused by the war created several new industries in Eire in 1942 and revived others. The Emergency Research Bureau was responsible for the operation of some of them, according to the Eire press.

Through the efforts of the Bureau, formalin has been made in Eire during the past year, and the production of glycerin, to meet essential requirements, also was undertaken.

A special plant was set up to produce carbon dioxide gas from brewery vats, a project which operated quite successfully. Another plant has been manufacturing zinc oxide during the past year. This product was formerly imported and has been practically unobtainable from foreign sources.

FORECAST FOR ARGENTINA LINSEED CROP

The first official forecast of Argentina's 1942-43 linseed crop is set at 1,600,000 metric tons, a figure identical with the corresponding estimate of the 1941-42 crop. It is the opinion in the trade, however, that the official estimate is too optimistic, and that the crop may be a disappointment throughout the country. Export sales of linseed during 1942 were only a fraction of those in previous years, and little hope is held that the 1943 figures will prove any better.

Crushing of linseed has been increased by the Government so that seed and oil may be used for fuel in 1943, as a substitute for fuel oil, Diesel oil, and gas oil.

CHROME CHEMICALS NOW MADE IN SOUTH AFRICA

The new plant of Marble, Lime & Associated Industries, Ltd., for the manufacture of chrome chemicals in South Africa has been completed, according to the company's annual report. Since the capacity of the new factory now exceeds domestic requirements, an export trade has been started.

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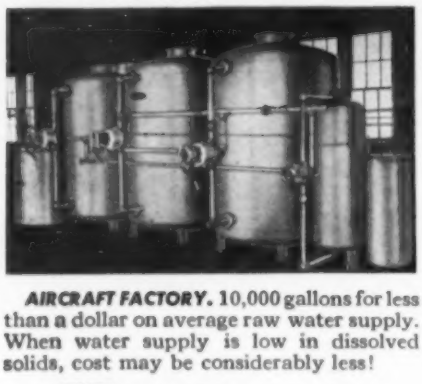

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SELECTIONS FROM FOREIGN LITERATURE

PALLADIUM ELECTROPLATING

EXPERIMENTS were conducted to study conditions for obtaining lustrous and thick deposits of palladium from solutions of palladium hydrochloric acid, the chloropalladites of sodium, potassium and ammonia, and complex palladium compounds containing NH_2, PO_4, NO_2 and CN groups.

Palladium anode dissolves in both solutions of palladium hydrochloric acid and ammonium chloropalladite. Lustrous and slightly porous deposits, from 0.5 to 1 micron thick, can be obtained from amino-nitrite, nitrite and amino-cyanide baths. Phosphate and ammonium chloropalladite baths produce deposits of somewhat inferior quality. Attempts to obtain satisfactory deposits from electrolytes containing palladium hydrochloric acids or the chloropalladites of sodium and potassium were not successful.

Palladium precipitates become tarnished during formation under certain conditions due to the contact precipitation of palladium simultaneously with cathodic dissolution of copper. This results in a loosely adhering precipitate, the pores of which are easily penetrated by copper compounds. The more electronegative the metal on which palladium is deposited, the poorer the quality of the deposit. Good deposits can be obtained on copper and silver, but not on aluminum and iron. Amino-nitrite baths can give deposits of palladium in successive layers, which is of great practical importance in plating small weights and measuring instruments.

Digest from "Application of Palladium for Electroplating," by M. A. Klochko and Z. S. Medvedeva, *Zhurnal Prikladnoi Khimii* 15, No. 1-2, 25-46, 1942. (Published in Russia.)

LOW TEMPERATURE ANILINE POINTS

AT TEMPERATURES below the "aniline point" mixtures of hydrocarbons and aniline separate into two layers. Tests have been carried out tracing and variation in the composition of these layers. The greatest difference is at low temperature with the layers approaching each other in composition as the aniline point is approached. Aromatics are most readily absorbed by aniline, then naphthenes, and lastly paraffins.

A systematic investigation is reported covering the conditions where separation into two liquid layers changes to crystallization of the blend using equal volumes of aniline and hydrocarbon. It is shown that a true aniline point cannot be determined for an aromatic hydrocarbon occurring in the solvent range, since the peak of the critical solution temperature curve falls below the freezing point curve. A technique is described by which true C.S.T. curves were obtained in the supercooled region.

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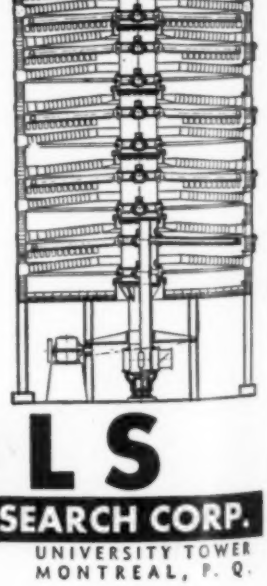

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The validity of the Tizard and Marshall method of determining aromatics by aniline point lowering has been examined, and it is shown that this method leads to large errors unless the molecular range (A.P. lowering) corresponds to the motor spirits originally used in devising the method. Many of the high aromatic solvents used in industry are of a higher molecular weight range, and a curve appropriate to their condition should be used.

Digest from "Low Temperature Aniline Points," by N. W. Gillam, *Australian Chemical Institute Journal & Proceedings*, **9**, 230–244, 1942. (Published in Australia.)

TIN-BASE ALLOYS

EFFECT on hardness, produced by quenching from the higest practicable temperature followed by prolonged tempering at 100 deg. C. and 140 deg. C., has been examined for 80 tin-base alloys containing 4 to 14 percent antimony and zero to 10 percent cadmium. It is shown that these alloys can be hardened by heat treatment and maintain a useful degree of improvement for at least 1,000 hr. at 100 to 140 deg. C. The best alloys in this respect are those in the range Sb 9 to 10 percent, Cd 1 to 1½ percent, balance Sn. The degree of improvement is indicated by Vickers diamond pyramid hardness tests. Values of 33 to 34 are obtained, compared with values of 26 to 30 in the normal non-heat-treated condition.

Digest from "Hardness of Tin-Base Alloys," by W. T. Pell-Walpole, *Journal of the Institute of Metals*, **68**, October 1942. (Published in England.)

OZONING AIR

ALTHOUGH nitrogen apparently acts simply as a diluent when mixed with oxygen for ozonization by ultraviolet light, carbon dioxide has a very different effect. In fact, a mixture of 80 parts carbon dioxide and 20 parts oxygen gives a somewhat higher yield of ozone than does oxygen alone. Probably carbon dioxide does not increase the formation of ozone from oxygen under irradiation with ultraviolet light, but functions by absorbing radiant energy which otherwise would break down the ozone molecules.

Digest from "Influence of Inert Gases on Ozone Production by Ultraviolet Light," by E. Briner, G. Papazian and H. Karbassi, *Helvetica Chimica Acta* **25**, 892–900, 1942. (Published in Switzerland.)

SUPERCHARGING ENGINES

INCREASING the output of compression-ignition engines by supercharging reaches a limit when the compression pressure reaches the maximum permissible operating pressure. Cycle efficiency falls by then to the level corresponding to full operation at constant pressure. A study of the increase in power output achieved by lowering the compression ratio during supercharging indicated that both power output and economy call for the highest pressure permitted by the prevailing conditions. For a given maximum pressure the maximum gross output of a power cylinder is appreciably

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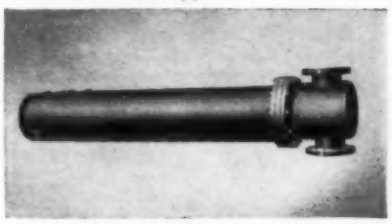

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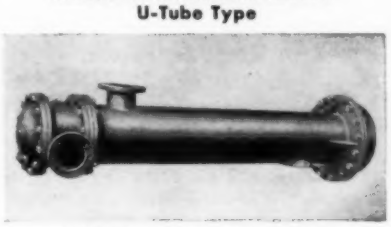

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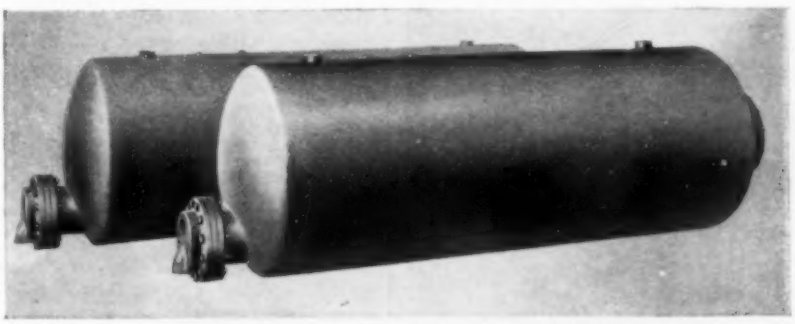

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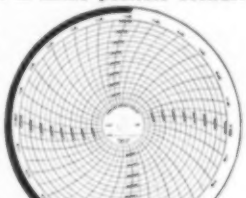

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increased by lowering the expansion ratio. The type of blower and its efficiency greatly influence the net output and the Roots blower is limited by its low cycle efficiency to relatively low boost ratios. Apparently a boost ratio of about 1.5 is the economic limit for this blower. A blower which gives adiabatic compression and is about 80 percent efficient effects substantial savings in cost of compressed air as compared with Roots blowers, but the latter have certain mechanical advantages. Blower efficiency is a major factor in attaining high power output.

Digest from "Supercharging the Compression-Ignition Engine," by C. B. Dicksee, *Gas and Oil Power*, Annual Technical Review Number, 228–32, 1942. (Published in England.)

COAL WASHING

One of Brazil's long standing problems is the washing of her low grade coals which contain shist, clay, and pyrites. The washing is desirable to make the coal uniform in quality as well as to increase the heating value, decrease the ash and possibly recover the sulfur.

By definition, material with an ash content below 5 percent was considered pure coal, and above 65 percent pure gangue. It was found that different screen sizes of coal had the same volatile matter content, but the coarser the particles the greater the ash. The density of the gangue averaged 2 for dust, 2.3 for 10 to 30 mesh and up to 4 for coarser sizes. Washing tests on Cambrú coal in 16, 18, 20, 30 and 40 mesh sizes gave about equally successful results, 86 percent was recovered as coal, averaging just under 10 percent ash and just over 2 percent sulfur. The original sample contained 15.9 percent ash and 6.5 percent sulfur.

Two present washing plants, at Rio América and Barro Branco, are briefly described. A diagram is given of the plant projected for São Paulo to wash coal for the gas works. São Paulo is distant from the mines, and after 1 or 2 years when the "bugs" have been ironed out it is proposed to move the plant to the mines. For the first trials São Paulo is preferred on account of availability of electric energy, labor, analytical laboratories, and technical supervision. Jigs and Wilfley tables are to be employed, with a capacity of 25 m. ton of feed per hour, under 2 mm. in particle size.

Digest from "Washing of Coal in Brazil (New Plant for São Paulo)," by Antonio Furia, Revista Brasileira be Quimica, 14, 201-9, 1942. (Published in Brazil.)

GLACIAL METAPHOSPHORIC ACID

Analysis of various samples of reagent metaphosphoric acid indicates that the usual concentration of metaphosphoric acid is between 35 and 50 percent, the accompanying materials being orthophosphoric acid, 0.3-3.9 percent; pyrophosphoric acid, 23-33 percent; and sodium oxide approximately 18 percent with between 6-10 percent of combined water. A method for the volumetric analysis for such materials is discussed

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in detail. The course of the conversion of orthophosphoric acid-sodium orthophosphate mixtures to material approximating closely to reagent metaphosphoric acid was studied and a method suitable for the preparation of this material in the laboratory is described. The course of hydrolysis of the metaphosphoric acid when in solution was studied under a number of conditions.

Digest from "The Analysis and Preparation of Glacial Metaphosphoric Acid" by Ian Brown. *The Australian Chemical Institute Journal & Proceedings*, **9**, 212-220, 1942. (Published in Australia.)

BRAZILIAN BAUXITE FOR SUGAR REFINING

BAUXITES from the region of Pocos de Caldas, Brazil, differ from one another in iron and silica contents, but the Al_2O_3 is usually in the neighborhood of 60 percent and the water of combination at about 29 percent. Such bauxites start losing water at about 250 deg. C. and at 400 deg. C. some 80 percent of the water is eliminated. Two samples of Pocos de Caldas bauxite were used for the sugar clarification experiments. One, designated as the "dark-colored," was a mixture of several types of the mineral, while the "light-colored" sample had an unusual composition and low Fe_2O_3 and SiO_2 content. The adsorption tests were made on solutions of 250 g. of unrefined sugar per liter of water, 180 g. of the sugar being actually dissolved. One liter of this solution and 300 g. of the adsorbent were used for each experiment, the solution being percolated through the adsorbent at the rate of 10 cc. per minute. Results are given in the accompanying table.

Adsorption Tests on Unrefined Sugar

	Sucrose, per-cent	Invert Sugar, per-cent	Ash, per-cent	Color*
Original	80.0	11.2	0.70	..
"Dark" Bauxite dehydrated at:				
300 deg. C.	83	9.3	0.17	20
400 deg. C.	83	9.2	0.17	8
500 deg. C.	79.5	11.5	0.18	9
600 deg. C.	79.5	9.7	0.27	9.5
800 deg. C.	83	10.9	0.30	16
"Light" bauxite dehydrated at:				
300 deg. C.	85	8.9	0.35	20
400 deg. C.	82	9.0	0.31	8.5
500 deg. C.	82	10.2	0.08	7.5
600 deg. C.	83	9.4	0.20	8.9
800 deg. C.	80.5	9.8	0.22	10.5
Active carbon, 1%	81	12.8	0.87	7.5

* Number of cc. of original solution diluted to 100 cc. to produce a color identical to that of the solution treated.

Pocos de Caldas bauxite dehydrated at about 400 deg. C. and with a 5–8 percent loss on ignition shows an appreciable adsorption capacity for sugar solutions. The adsorption capacity is little affected by wide differences in chemical composition, as shown by the two types used in these experiments. However, there are indications that bauxite with a high Al_2O_3 content regains its adsorbing power on regeneration more readily than the other types.

Digest from "Utilization of Bauxite as an Adsorbent in the Clarification of Sugar," by Francisco J. Maffei, *Anais da Associacao Quimica do Brazil*, **1**, No. 1, 11-15, 1942. (Published in Brazil.)

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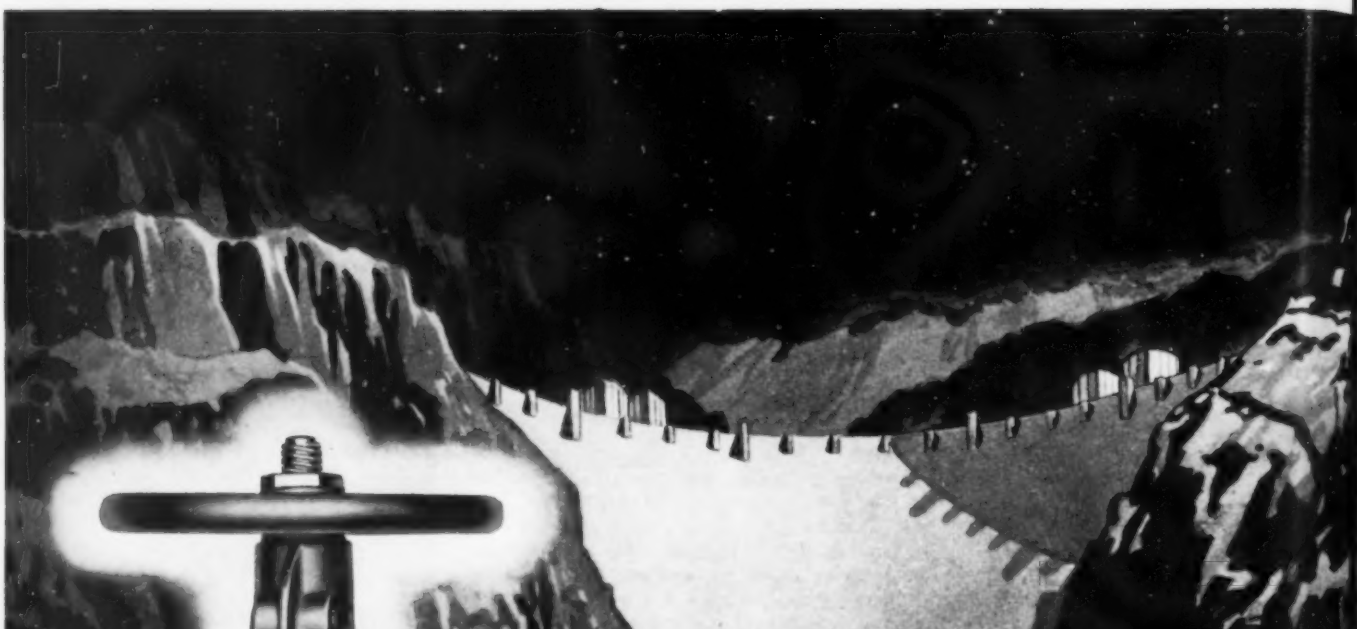

Fig. 2453—Large size O. S. & Y. Gate Valve with flanged ends, outside screw rising stem, and full flanged bolted yoke bonnet. Sizes 2½" to 30", inclusive, for 125 pounds W. P.

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DIRECTORY OF PLASTICS

PLASTICS CATALOG, 1943. Published by Plastics Catalog Corp., New York, N. Y. 864 pages. Price $5.

This new edition is a worthy successor to the catalog published a year ago. In an industry as young and vigorous as plastics, numerous changes take place within the short period of 12 months fully justifying the annual volume.

An interesting new feature is the section on Plastics in War. This is extremely timely in view of the fact that almost all materials are going into products for the armed forces. The section dealing with plywood and related products has been enlarged in keeping with the rapidly expanding use for resins as adhesives, a field that promises much for postwar times. Another timely subject, Synthetic Rubber and Rubber-Like Plastics, has been enlarged to meet the growing interest and developments of the past year. Plastic Materials Manufacturing is illustrated by pictured flowsheets. A few new ones have been added. One of the most worthwhile divisions covers the various plastic materials. The chemistry of each type is discussed along with principal applications, new developments, trends and information which should be included in such an encyclopedia on plastics. The other sections are concerned with coatings, molding and fabrication, finishing and assembly, machinery and equipment and fillers.

MANUAL OF EXPLOSIVES, MILITARY PYROTECHNICS AND CHEMICAL WARFARE AGENTS. By *Jules Bebie*. Published by the Macmillan Co., New York, N. Y. 171 pages. Price $2.50.

Although it is called a manual of explosives, this book is really a dictionary. There are listed some 500 military and industrial explosives and war chemicals used both for offense and defense. The entries include items of current and historical interest and are listed alphabetically with information on composition, symbol, properties and uses. Cross references to chemical names and synonyms, American and foreign trade names, and warfare symbols enable quick location of information.

THE CHEMICAL ASPECTS OF LIGHT. By *E. J. Bowen*. Published by Oxford University Press, New York, N. Y. 191 pages. Price $4.

Theories of light and all phenomena connected with light, such as fluorescence, luminescence, photochemistry, chemiluminescence, photosynthesis and so forth are explained and discussed in this book in non-mathematical language. Many diagrams are used to educate the reader. For example, the schematic diagram of potential energy vs. interatomic distance is used in the discussion of dissociation and zero-point energies. Only a small number of literature references (45 papers) is given at the end of the book. While many will find this book very interesting to read, others will question the method of presentation. Phenomena connected with radiation can only be adequately explained through the use of quantum mechanics and thus the absence of all mathematics is a decided disadvantage. However a reader who does not want to go deeply into this subject and only wishes to obtain a superficial qualitative knowledge of the subject will find this book a pleasant guide.

DIRECTORY OF GAS UTILITIES IN THE UNITED STATES 1942. Published by Federal Power Commission, Washington, D. C. 536 pages. Price $2.

In this volume the Commission, with the aid of its authority to command complete and prompt returns, has been able to do a splendid job. Information is included regarding the name, address, corporate control of each enterprise, and the subsidiaries controlled. Additional entries give executive personnel and much descriptive information. Technical facts regarding type and magnitude of business makes this the most complete record anywhere available for use by those buying from or selling to the utility companies of the country, both those supplying manufactured gas and those supplying natural gas.

The arrangement permits a critical analysis by geographic areas, even including information as to which communities have no gas distributing systems. Suppliers of materials and machinery can thus determine with accuracy the magnitude of markets, and users of coal and oil products can determine all potential raw material sources of these byproducts. Any enterprise or library which has any interest in the gas utilities of the country will find this a "must" volume.

ORGANIC REAGENTS IN INORGANIC ANALYSIS. By *Ibert Mellan*. Published by The Blakiston Co., Philadelphia, Pa. 682 pages. Price $9.

The Tables of Reagents for Inorganic Analysis (Leipzig, Akademische Verlagsgesellschaft) were published in 1938. In this important book, the best analytical procedures for inorganic ions were tabulated, and the stress was placed on the inorganic side. The second part of Mellan's text starting from page 227, deals also with this subject, stressing however the organic reagent which is used in the specific reaction. In the first part of the book, where fundamental theories and principles and the organic reagents are discussed, entirely new matter is introduced.

This book has been painstakingly prepared and the literature quotations in the text amplify and make especially valuable this comprehensive treatise. A book by von Stein bearing the same title and published in 1942 attempted to cover the same scope in 242 pages. Mr. Mellan has made a real contribution to chemical literature.

THE THEORY OF EMULSIONS AND THEIR TECHNICAL TREATMENTS. Fourth edition. By *William Clayton*. Published by The Blakiston Co., Philadelphia, Pa. 492 pages. Price $10.

Reviewed by *F. C. Nachod*

The well-known treatise on emulsions appears in the fourth edition. The frame is much the same as the third edition of the year 1935, but the introduction into surface phenomena in the first chapter is by far more logical as compared with the preceding edition where this subject was found in chapter two. Much new material has been introduced and a summary of important patents since 1934 in appendix II adds great value to the book. The enormous field which is steadily expanding necessarily calls for some limitations and thus not all emulsions occurring in industry are discussed, but critical selection has been made.

It is a good record for any book to have passed through a German (1924) and a Russian (1933) translation. This seems to the reviewer somewhat symptomatic, as the years indicate a nation, great in chemistry in bygone days, and another nation, which has shown magnificent development and progress in the past decade, promising to be among the leaders in chemistry and physics.

THE PRINCIPLES OF METALLOGRAPHIC LABORATORY PRACTICE. Second Edition. By *George L. Kehl*. Published by McGraw-Hill Book Co., Inc., New York, N. Y. 453 pages. Price $4.

Because of the favorable reception accorded the first edition (1939) of this textbook, the author has kept this revised edition to the original objective of providing a fundamental treatment of metallographic laboratory principles. The purpose of the volume is to bridge the gap between theoretical physical metallurgy and its practical application in the laboratory. Data on the latest and supplementary laboratory manipulations and processes have been added, and illustrations showing the contrast between results of proper and improper procedures are more numerous than in the previous edition. The appendix, containing extensive data on etching reagents, hardness numbers, etc., has been rearranged and expanded.

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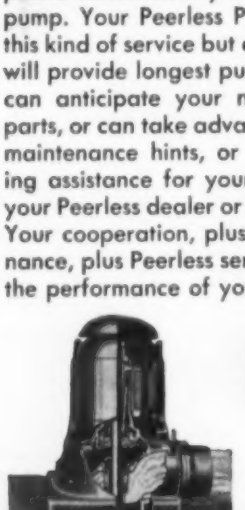

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A. S. T. M. Specifications for Steel Piping Materials. Published by American Society for Testing Materials, Philadelphia, Pa. 249 pages. Price $1.75. All A. S. T. M. specifications covering steel piping materials: boiler and miscellaneous tubes, various types of pipe for normal and elevated temperature service, heat-exchanger and condenser tubes, castings for valves, forgings and fittings, carbon and alloy-steel nuts and bolting material. Many emergency alternate provisions are included.

How Can We Pay for the War? By *M. S. Stewart.* Pamphlet No. 74 published by Public Affairs Committee, New York, N. Y. 31 pages. Price 10 cents. Taxes, price ceilings, war bonds and national income.

Survey of Business Research Projects at Universities. Published by United States Department of Commerce, Washington, D. C. 188 pages. A compilation of the studies in business and economic research recently completed or in process in universities, colleges and research institutions.

Wage and Salary Stabilization. Published by the Research Institute of America, New York, N. Y. 59 pages. Price $2. A report to assist in making the best possible adjustments under the new wage and salary regulations.

War Production in 1942. Obtainable from Office of War Information, Washington, D. C. 21 pages. Reviews production accomplishments and problems, discusses some of the major problems and describes the present organization.

100 Years of Peace and War. Published by Joseph T. Ryerson & Son, Chicago, Ill. 20 pages. An illustrated booklet issued in commemoration of Ryerson's 100th birthday.

Make or Buy. By *J. W. Culliton.* Business Research Studies No. 27, published by Harvard Graduate School of Business Administration, Boston, Mass. 130 pages. Price $1.50. Considers fundamental factors involved in the decision to make or buy. Based on the study of experiences of a number of industrial firms.

Simplified Procedure for Selecting Capacities of Duct Systems for Gravity Warm-Air Heating Plants. By *A. P. Kratz* and *S. Konzo.* Circular Series No. 45, Engineering Experiment Station, University of Illinois, Urbana, Ill. 48 pages. Price 55 cents. Presents a method which may be considered as an extension or practical application of the principles underlying the Standard Code.

Technique of Plywood. By *C. B. Norris.* Published by I. F. Laucks, Seattle, Wash. 250 pages. Price $2.50. A revised second edition.

Bibliography of the Literature Relating to Constitutional Diagrams of Alloys. By *J. L. Haughton.* Published by Institute of Metals, 4 Grosvenor Gardens, London, S. W. I. 163 pages. Price 3s. 6d. Contains over 5,000 references to papers dealing with the constitution of binary and higher alloy systems, both ferrous and non-ferrous. It is intended that the bibliography shall be used to conjunction with the abstracts that the Institute of Metals has published, therefore, references have been included to these abstracts, whenever such exist.

The Chemical Age Year Book, 1943. Published by Benn Bros., Ltd., Fleet St., London. 175 pages. Size of this British buyers guide has again been reduced, this time to 6x9 in. Type of material remains the same, however, and the usual tables of physical and chemical data have been retained.

How Management Can Integrate Negroes in War Industries. Prepared by *J. A. Davis.* Published by New York State War Council, Committee on Discrimination in Employment. 43 pages. Examples and experiences of many firms in the successful employment of colored workers.

Die Casting for Engineers. Published by the New Jersey Zinc Co., New York, N. Y. 148 pages. Price $1. A complete little treatise on history, principles, alloys, dies, applications, specifications, inspection, machining, jigs and fixtures for machining, finishes, and design of die castings.

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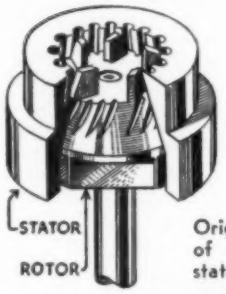

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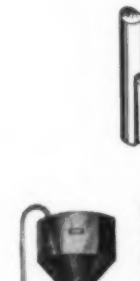

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Transportation and National Policy. National Resources Planning Board, unnumbered. Price $1.25.

Defense Against Chemical Attack. War Department. Field Manual FM21-40. Price 35 cents.

Interstate Trade Barriers—Outlines of Studies. Prepared by The Marketing Laws Survey. Department of Commerce. Unnumbered. Price 75 cents, cloth bound.

Suggested Research Topics in the Fields of Business and Economics, 1942. Bureau of Foreign and Domestic Commerce, unnumbered.

War Jobs for Women. Office of War Information, unnumbered. Price 10 cents.

A Survey of Business Research Projects at Universities. Bureau of Foreign and Domestic Commerce, unnumbered.

Nickel-Copper Deposit at Snipe Bay, Baranof Island, Alaska. Geological Survey, Bulletin 936-M. Price 10 cents.

Chromite Deposits of Red Bluff Bay and Vicinity, Baranof Island, Alaska. Geological Survey, Bulletin 936-g. Price 20 cents.

Water Permeability and Weathering Resistance of Stucco-Faced, Gunite-Faced, and "Knap Concrete-Unit" Walls. By Cyrus C. Fishburn. National Bureau of Standards, Building Materials and Structures Report BNS94. Price 10 cents.

Specifications, Tolerances, and Regulations for Commercial Weights and Measures and Weighing and Measuring Devices. National Bureau of Standards, Handbook H29. Price 60 cents cloth bound.

Mineral Dressing of Oregon Beach Sands. 1. Concentration of Chromite, Zircon, Garnet, and Ilmenite. By John Dasher and others. Bureau of Mines, Report of Investigations R. I. 3668. Mimeographed.

Extinguishing Magnesium Fires with Hard Pitch Derived from Coal Tar. By H. R. Brown and others. Bureau of Mines. Report of Investigations R. I. 3672. Mimeographed.

Report of the Nonmetals Division, Fiscal Year 1942. By O. C. Ralston and others. Bureau of Mines, Report of Investigations R. I. 3675. Mimeographed.

Inflammability of Trichloroethylene-Oxygen-Nitrogen Mixtures. By G. W. Jones and others. Bureau of Mines, Report of Investigations R. I. 3666. Mimeographed.

Contact Potential in Electrostatic Separation. By Foster Fraas and Oliver C. Ralston. Bureau of Mines, Report of Investigations R. I. 3667. Mimeographed.

Proposed Methods and Estimated Costs of Mining Oil Shale at Rulison, Colo. By E. D. Gardner and Charles N. Bell. Bureau of Mines, Information Circular I. C. 7218. Mimeographed.

Reciprocal Trade. Department of State, Publication 1306. Executive Agreement Series 248. Agreement between United States and Equador modifying earlier trade agreement. Price 5 cents.

Census of Pulp Mills and of Paper and Paperboard Mills, 1941. Gives data for wood pulp production at pulp mills and paper and paperboard production and the consumption of wood pulp and other fibrous materials. Bureau of Census. Mimeographed.

T. V. A. Report. Mimeographed summary of report of Tennessee Valley Authority to the President and Congress. (Formal report will not be printed.) Given out as press release of Office of War Information, Item OWI-1043.

Production of Electric Energy and Capacity of Generating Plants, 1941. Federal Power Commission, unnumbered. Price 25 cents.

Digest of State and Federal Labor Legislation, Enacted July 1, 1941 to August 1, 1942. Division of Labor Standards, Bulletin No. 51. Price 10 cents.

Health Hazards From Inadequate Coal Mine Ventilation. Bureau of Mines, Information Circular I. C. 7221. Mimeographed.

Directions for Laboratory Mineral Sizing. By John Dasher. Bureau of Mines, Information Circular I. C. 7224. Mimeographed.

American Tobacco Types, Uses, and Markets. By Charles E. Gage. Department of Agriculture, Circular No. 249. Price 30 cents.

Drawback of Tax on Distilled Spirits Used in the Manufacture of Nonbeverage Products Under the Internal Revenue Code. Bureau of Internal Revenue, Regulations 29 (1942 Edition). Price 5 cents.

Notes on City Gas for Air Raid Wardens. Office of Civilian Defense. Unnumbered Document. Price 5 cents.

Interchange of Patent Rights, Information, Inventions, Designs, or Processes. Department of State Publication 1803, Executive Agreement Series 268. Agreement between the United States of America and Great Britain Signed at Washington August 24, 1942. Effective January 1, 1942.

State Minimum-Wage Laws and Orders: 1942. By Florence P. Smith. Department of Labor, Women's Bureau, No. 191. (Revision of Bulletin No. 167.) Price 20 cents.

The Chemical Laboratory Company. War Department, Chemical Warfare Service, Field Manual FM 3-25.

Laundries, Laundry Battalions and Laundry Companies. War Department, Technical Manual TM-10-350.

Treatment of Casualties from Chemical Agents. War Department, Technical Manual TM-8-285.

Compressed Gas Cylinders; Safe Handling, Storing, Shipping, Using. War Department, Army Regulations No. 850-60. Price 5 cents.

Veterinary Meat and Dairy Hygiene, General. War Department, Army Regulations No. 40-2150. Price 5 cents.

Strength of Aircraft Elements. Joint Publication of War, Navy, and Commerce Departments, ANC-5, issued by the Army-Navy Civil Committee on Aircraft Design Criteria. Price 35 cents. Mimeographed.

Leather, Footwear, and Allied Industries. Bureau of Foreign and Domestic Commerce, Inquiry Reference Service. Unnumbered Document. Mimeographed.

Handbook of Definitions of Materials and End Products. U. S. Navy Department. Unnumbered Document.

Population. Number of Inhabitants, Volume I. Sixteenth Census of the United States: 1940. Bureau of the Census. Unnumbered Document. Price $2.50. Clothbound.

Distribution of Manufacturers' Sales, 1939. Census of Business, Volume V. Sixteenth Census of the United States. Price $1.25. Buckram.

Some Physical Properties of Butadiene and Styrene. By Lawrence A. Wood and Catherine F. Higgins. National Bureau of Standards, Letter Circular LC-710. Mimeographed.

Paints and Other Protective Coatings for Tires. By Archibald T. McPherson and Eugene F. Hickson. National Bureau of Standards, Letter Circular LC-709. Mimeographed.

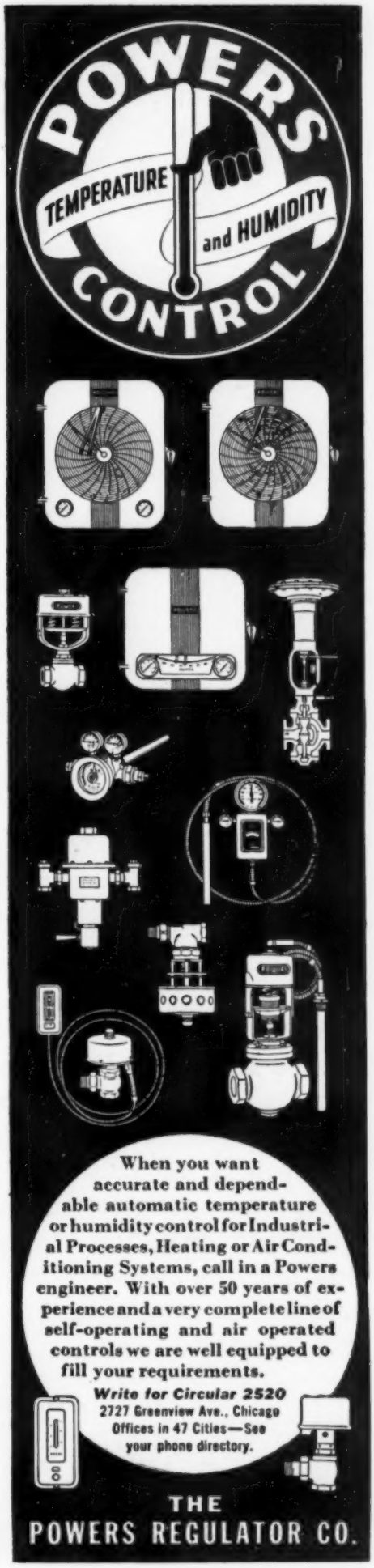
Wire Rope. Simplified Practice Recommendation. R198-43. Bureau of Standards. Mimeographed.

Commercial Electric Refrigeration Condensing Units. Commercial Standard (Emergency) CS (E) 107-43. National Bureau of Standards, TS-3428. Mimeographed.

Preventing Damage to Buildings by Subterranean Termites and Their Control. Department of Agriculture, Farmers' Bulletin No. 1911. Price 10 cents.

The Agriculture of Colombia. By Kathryn H. Wylie. Office of Foreign Agricultural Relations. Unnumbered Document. Price 20 cents.

Metal- and Nonmetal-Mine Accidents in the United States, 1940 (Excluding Coal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Mines). By W. W. Adams and M. E. Kolhos. Bureau of Mines Bulletin 450. Price 10 cents.

Analyses of Pennsylvania Bituminous Coals. Bureau of Mines, Technical Paper 645. Price 10 cents.

Active List of Permissible Explosives and Blasting Devices Approved Prior to June 30, 1942. Bureau of Mines, Report of Investigations R. I. 3665. Mimeographed.

Annual Report of the Explosives Division, Fiscal Year 1942. By W. J. Huff. Bureau of Mines, Report of Investigations R. I. 3669. Mimeographed.

Moisture Losses in Sampling Coal. By H. M. Cooper and others. Bureau of Mines, Report of Investigations R. I. 3670. Mimeographed.

Carbonization of Bevier-Bed Coal from Kansas and Production of Blue Water Gas from the Resulting Coke. By W. W. Odell. Bureau of Mines, Report of Investigations R. I. 3671. Mimeographed.

Stemming in Metal Mines. Progress Report 5. By J. A. Johnson and Wing G. Agnew. Bureau of Mines, Report of Investigations R. I. 3673. Mimeographed. Comparison of Dust and Gases Produced from Blasting Charges of Dynamite in Drill Holes, in Bombs, and in Mud-cap Shots.

An Electrostatic Separator for Fine Powders. By F. Fraas and O. C. Ralston. Bureau of Mines, Report of Investigations R. I. 3677. Mimeographed.

Dolomite-Base Refractories. By Alvin Schallis. Bureau of Mines, Information Circular I. C. 7227. Mimeographed.

Marketing Lithium Minerals. By L. G. Houk. Bureau of Mines, Information Circular I. C. 7225. Mimeographed.

Typical Analyses Bituminous Coals Produced in Districts 10 and 11. Bituminous Coal Commission, Department of Interior. Data Book. Volume V. Price 15 cents.

The Three Kids Manganese District, Clark County, Nevada. By C. B. Hunt and others. U. S. Geological Survey Bulletin 936-L. Price 30 cents.

Nickel-Copper Deposit at Snipe Bay, Baranof Island, Alaska. U. S. Geological Survey Bulletin 936-M. Price 10 cents.

Tin-Spodumeme Belt of the Carolinas. By T. L. Kesler, U. S. Geological Survey Bulletin 936-J. Price 50 cents. A preliminary report.

Nickel-Copper Deposit at Funter Bay, Admiralty Island, Alaska. By J. C. Reed. U. S. Geological Survey Bulletin 936-I. Price 15 cents.

Water Supply of the Dakota Sandstone in the Ellendale-Jamestown Area, North Dakota. By L. K. Wenzel and H. H. Sand. U. S. Geological Survey Water-Supply Paper 889-A. Price 50 cents. Reference to changes between 1923 and 1938.

Drainage of Agricultural Lands. Sixteenth Census of the United States. Bureau of the Census. Unnumbered document. Price $2.00, cloth bound.

Agriculture: Cows Milked and Dairy Products. Sixteenth Census of the United States. Bureau of the Census. Unnumbered document. Price $1.25, cloth bound.

Smelting of Vanadium-Bearing Titaniferous Sinter in an Experimental Blast Furnace. By C. E. Wood and others. Bureau of Mines, Report of Investigations R. I. 3679. Mimeographed.

War Minerals Reports. The Bureau of Mines has prepared for official use an extended series of War Minerals Reports providing essential information regarding potential new mining and mineral properties. Through an error, these documents were announced as generally available. They are not available for distribution. The companies having a legitimate interest in support of the war effort may consult them at the Bureau offices either in Washington, or at the major field stations throughout the country. Inquiries regarding subjects and availability should be addressed to the Mining Division, U. S. Bureau of Mines, Washington, D. C.

Mineral Reports for 1942. Preliminary mimeographed summaries of production of minerals and mineral products during 1942 are being issued by the Bureau of Mines in its series of documents called Mineral Market Reports. The subjects covered are the same as those reported on later in the year in the Minerals Yearbook of the Bureau. Those requiring data on any mineral commodities should identify the specific commodities for which information is needed when addressing the Bureau at Washington. General mailing lists for all such material are not maintained except for libraries.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Aluminum. Aluminum Company of America, Pittsburgh, Pa.—100-page spiral bound notebook entitled "Welding and Brazing Alcoa Aluminum," which discusses in detail gas, arc, and electric-resistant welding as well as furnace, torch, and other methods of brazing. Includes data on selection and specifications, cleaning joints, fluxes, etc. Contains useful engineering data. Well illustrated by photographic reproductions, diagrams and charts.

Automatic Control. General Electric Co., Schenectady, N. Y.—Form GEA 1755 —4-page form, illustrated, describing briefly and giving application data on this concern's photoelectric relays for automatic control. Also includes condensed information on light sources and accessories.

Automatic Control. Leeds & Northrop Co., 4907 Stenton Ave., Philadelphia, Pa. Catalog NOOA—30-page catalog entitled "Micromax Electric Control," which discusses principles of automatic electric control, describes and illustrates this concern's line of indicating controllers, primary elements and control devices.

Belts. Audubon Wire Cloth Corp., Richmond St. & Castor Ave., Philadelphia, Pa.—Bulletin 8—4-page form illustrating and giving specifications and details on this concern's line of "Metalwove" belts for industrial washing and drying operations. Includes condensed information on industrial applications.

Blowers. Allen Billmyre Corp., 431 Lafayette Ave., Mamaroneck, N. Y.—12-page folder illustrating and describing briefly this concern's line of products, including turbo blowers and exhausters, gas boosters, industrial and power plant stationary vacuum cleaner systems, portable vacuum cleaners and Pottstown positive rotary blowers.

Brushes. Atlanta Brush Co., 30 Hilliard St., Atlanta, Ga.—48-page catalog dealing with this concern's line of industrial brushes of all types. Includes a section on brush repairing and auxiliary card brushes. Each unit is illustrated, described briefly, and includes dimension and weight data. Extensively illustrated.

Burners. The Selas Co., Erie Ave. & D St., Philadelphia, Pa.—8-page booklet dealing with this concern's line of burners for flame-hardening, flame-annealing, brazing, preheating, sealing and other localized open heat treatments. Contains illustrations, charts and tables of engineering data.

Cellulose Plastics. Celanese Celluloid Corp., 180 Madison Ave., New York, N. Y. —64-page booklet entitled "Cellulose Plastics in War and Industry." Intended as a manual of specifications, properties and applications of sheets, rods, tubes, films and foils, molding materials, plasticizers, cements, dopes, and glazing materials put out by this concern. Includes extensive engineering data on the various plastics. Well illustrated.

Chemicals. Solvay Sales Corp., 40 Rector St., New York, N. Y.—30-page catalog giving condensed information on this concern's line of chemicals, including alkalies, calcium chloride and chlorine. Includes

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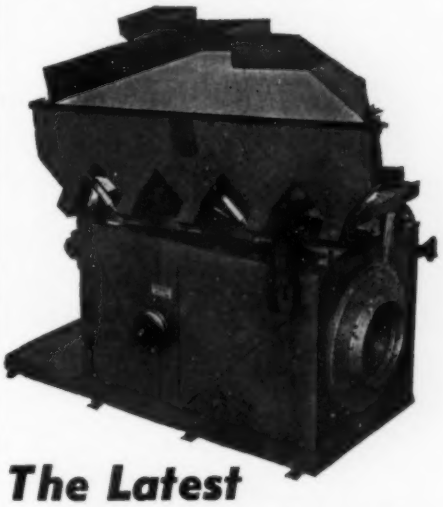

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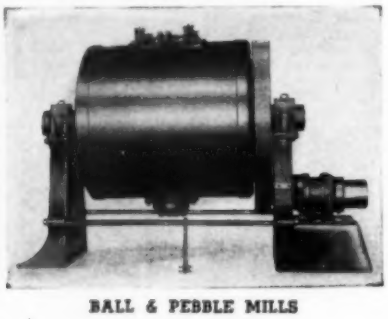
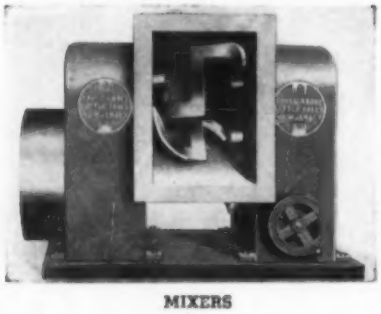


BALL & PEBBLE MILLS



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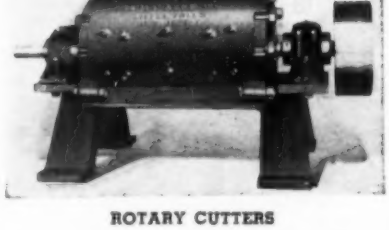

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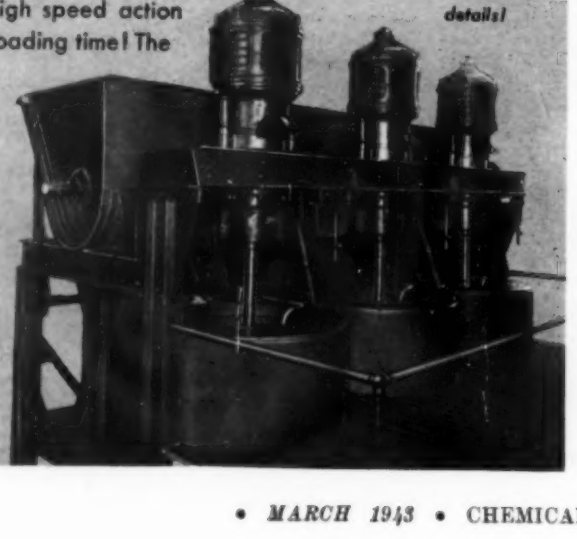

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Compressors. Allis-Chalmers, Milwaukee, Wis.—Form B6211—18-page booklet illustrating, describing briefly and giving extensive engineering and specification data on this concern's "Ro-Flo" compressors and vacuum pumps.

Condensate Return Units. Fred H. Schaub Engineering Co., Inc., 325 W. Huron St., Chicago, Ill.—Bulletin 1142—4 pages dealing with this concern's "Series G" condensate return units of the simplex and duplex types conforming to War Department specifications. Contains cross-sectional drawings and tables of dimensional data.

Condensation. J. W. Mortell Co., Kankakee, Ill.—30-page handbook illustrating and describing briefly how to prevent and cure damage from condensation and sweat on metal pipe fixtures, walls, ceilings of concrete, wood, plastic, etc. Includes instructions for application, coverage, drying time and uses for "No Drip".

Copper and Brass. Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.—Sixth edition of this concern's weight and data handbook. Includes a section giving technical and mill definitions and illustrations of terms used in copper and brass industry, chemical and physical properties of copper, brass and bronze, formulas for calculating weights, conversion factors, etc. Contains extensive engineering data.

Corrosion Control. The Bishopric Products Co., Inc., 4413 Este Avenue, Cincinnati, Ohio.—8-page folder describing and illustrating the advantages of this concern's "Lastiglas" glass-like synthetic lining for protection of chemical equipment against corrosion. Listed as an economical substitute for stainless steel, nickel alloy, aluminum, copper, brass and vitreous linings. Describes briefly and illustrates typical applications in industry and includes a partial chemical resistance chart.

Cranes. Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.—104-page spiral-bound notebook dealing with the maintenance and operation of this concern's electric cranes and hoists. Contains information on various types of cranes, bridges, monorail hoists, and single-speed hoists. Extensively illustrated with photographic reproductions, diagrammatic drawings, tables of engineering data and cross-sectional views.

Equipment. Blackmer Pump Co., Grand Rapids, Mich.—Vol. 1, No. 1 of this concern's new house organ entitled "The Blackmer Swinging Vane," which will be devoted to items of interest to the concern's clients.

Equipment. J. O. Ross Engineering Corp., 350 Madison Ave., New York, N. Y. —Bulletin 135, 130—15- and 20-page booklets dealing with this concern's line of air heaters and industrial ovens and dryers. Each unit is described briefly and illustrated by photographic reproductions and cutaway views. Includes data on industrial applications and capacities. Extensively illustrated.

Equipment. R. Geld & Sons, Inc., Union, N. J.—Bulletin A 105—8-page catalog listing and describing briefly the concern's supply of used equipment available at this time. Lists centrifugal dryers, kilns, filter presses, pulverizers, pumps, mixers and crystallizers, evaporators, kettles, tanks and miscellaneous items.

Filter Cloth. William W. Stanley Co., Inc., 401 Broadway, New York, N. Y.—two-page folder giving condensed information and representative samples of the concern's line of filter cloth in all weights and construction from cotton, wool, glass and acid- and alkali-proof fabrics. Includes brief information on industrial filtering applications.

Filtering. Niagara Filter Corp., 143 Niagara St., Buffalo, N. Y.—8-page booklet dealing with this concern's filter systems. Illustrates and discusses briefly the line of filters, mounting leaves, leaf construction and function, feeders and industrial applications. Well illustrated.

Flameproofing. Glyco Products Co., Inc., 230 King St., Brooklyn, N. Y.—

page bulletin entitled "Modern Flameproofing" containing information on the theory of flameproofing, flameproofing of textiles, paper and structural material, together with a synopsis of New York City laws on flameproofing of curtains, draperies, etc.

Plastics. E. I. du Pont de Nemours & Co., Plastics Department, Arlington, N. J.—Form A3352—8-page pamphlet titled "Engineering Highlights About du Pont Plastics". Contains charts giving mechanical, thermal, optical, electrical, molding and miscellaneous properties of "Lucite", "Plastacele", "Pyralin", "Nylon" and "Butacite". Also includes a list of applications.

Plastics. Monsanto Chemical Co., St. Louis, Mo.—16-page form entitled "A Wartime Guide to Monsanto Plastics" which describes briefly, illustrates, and gives physical properties of the concern's "Saflex" rubber-like plastic and its various molding compounds, sheets, rods and tubes.

Power Transmission. Dodge Manufacturing Corp., Mishawaka, Ind.—Catalog 42—388-page war-time manual on mechanical power transmission which gives complete descriptions, diagrams, dimensions and prices of thousands of power transmission appliances, with essential engineering data for proper design, installation and operation of mechanical power drives. Attention is given to products that may be used as alternates for those difficult to obtain. Also contains a section devoted to belt conveyors for bulk materials handling and engineering data essential in laying out belt conveyor systems. Contains extensive illustrations and charts of engineering data. Very complete.

Stainless Steel Equipment. S. Blickman, Inc., Weehawken, N. J.—14-page booklet entitled "What to Look for When You Specify Stainless Steel for Processing Equipment." Describes and illustrates proper finish, economical design, round corner construction, correct welded technique, etc., for stainless steel equipment. Illustrates and describes very briefly features of stainless steel equipment put out by this concern.

Synthetic Rubber. Pacific Pump Works, Huntington Park, Calif.—8-page folder illustrating and describing briefly the line of compressors, pumps, and similar equipment put out by this concern for use in butadiene and synthetic rubber plants. Contains installation photographs.

Trucks. Rose Manufacturing Co., 12400 Strathmoor, Detroit, Mich.—18-page section of a new industrial handling equipment catalog entitled "Trucks and Casters" which illustrates and describes briefly the most popular models of factory trucks and trailers, both all-steel and wood platform types. Includes information on this concern's dump hoppers and heavy-duty steel swivel or rigid casters. Extensively illustrated.

Valves. Merco-Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh, Pa.—Bulletin V 139, revised 1—100-page catalog giving detailed information on this concern's lubricated valves of various types. Contains data on semi-steel and steel valves, with photographic reproductions of each type, cross-sectional diagrams, tables on specifications and sizes, prices, etc. Also contains numerous photographs of industrial installations, data on valve wrenches, locking devices, etc. Includes extensive tables of engineering data.

Vitamins. Cincinnati Vitamin Co., 1542 Madison Road, Cincinnati, Ohio—12-page booklet entitled "Vitamins Are War Workers". Discusses the importance of vitamins in industry for protection of employees' health, maintenance of morale and increased production.

Wood Pipe. California Redwood Association, 405 Montgomery St., San Francisco, Calif.—Section 3, File 3D4—16-page booklet entitled "Redwood Pipe" which gives extensive engineering data on the use of redwood for construction of durable pipe. Lists advantages of the material, different types of redwood pipe and characteristics of each, buried pipe lines, air valves for wood stove pipe, connections between wood pipe and other structures, outlets, etc. Extensively illustrated with photographic reproductions, diagrammatic drawings and charts. Contains extensive engineering data in text, table, mathematical and photographic forms.

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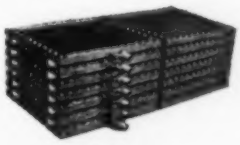

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ECONOMICS AND MARKETS

CONSUMPTION OF CHEMICALS IN GENERAL INDUSTRIAL LINES IS WELL STABILIZED

TOTAL DEMAND for chemicals has been on an ascending scale so far this year, yet consumption in the ordinary industrial lines is merely holding a steady rate with gains in some directions offset by lower operations in other industries. The Federal Reserve Board in reporting on conditions during the first six weeks of this year credits industrial operations with reaching a new high. The Board's index for industrial production rose three points in January to 200 percent of the 1935–39 average. A good part of this growth was attributed to higher activities in the munitions industry including the production of chemicals for war purposes.

Considerable publicity has been given to orders calling for discontinuance of work on war projects such as a Neoprene plant and the conversion of four oil refineries to the manufacture of butadiene. Such action is reported to have been taken because of the curtailment in the synthetic rubber program and because materials required for the completion of the proposed plants could be used to greater advantage elsewhere. Incidentally the output of synthetic rubber for the current year was estimated by the rubber director last month at 241,000 long tons and this total includes 3,000 tons to come from Canada. This of course was an estimate based on current conditions and may be revised upwards as there is a probability that butadiene plants will produce more than their accredited capacities.

Construction projects having a total cost of $4,161,181 were stopped during the week ended February 19 according to an announcement from the Office of War Information. The projects were halted through the revocation of preference ratings in conformance with the policy of curtailing construction not directly related to the war effort. From October 23, 1942 through February 19, the cost of all projects which have been halted amounts to $1,304,055,747 but a good part of this total was in connection with work on highways.

In spite of these curtailments of projected construction, the use of chemicals has gained steadily largely due to expansion in productive capacities at munitions works. New chemical capacities also are in operation as instanced in the case of new butadiene production in Louisiana and West Virginia. The industries which normally offer the largest outlets for chemicals, however, appear to be moving along a fairly even path with only minor fluctuations from month to month. This statement does not hold true for the individual industries as some of them are more active than they were a year ago and some have cut down operations. The iron and steel, rayon, and plastics industries are the ones most likely to make new records this year. The American Iron and Steel Institute has reported current steel capacity at 1,731,662 net tons per week as compared with 1,698,622 net tons a year ago. Rayon and plastic capacities also are larger than they were a year ago. Superphosphate production made a new record last year and the movement to increase crops this year should stimulate demand for fertilizer with the possibility that superphosphate may continue its record course.

Of the industries which are slated for curtailment this year, pulp and paper are prominent because their prospects can be more definitely appraised. Under government order, consumption of paper will be cut drastically. The effect on production is seen in predictions that paper mills this year will turn out less than 14,000,000 tons as compared with about 16,522,000 tons last year, the figures referring to paper and paperboard. Demand for paint last year was stimulated by war construction activity which was valued at more than 16 billion dollars. The monthly volume reached its peak in August and from that time the decline has been steady and progressively sharp. Oil refineries, which were very active throughout 1941, cut down runs to stills last year and so far have shown no indication of a pick-up.

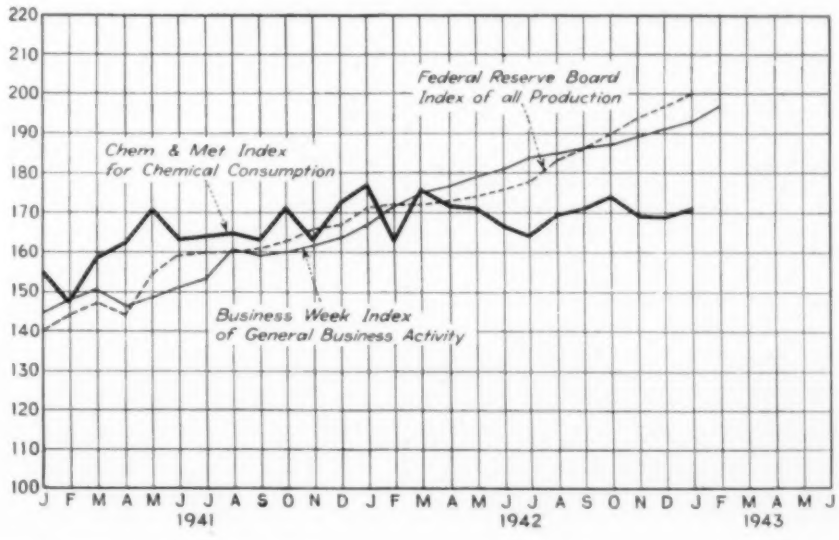
Activities at byproduct coke plants were moved up somewhat last year and held a very even pace in the latter part of the year. Apparently the rate has become pretty well standardized because the outputs reported for January—the latest month for which data are available—are in line with the monthly totals of a few months ago. Production of sulphate of ammonia in that month was reported at 128,231,841 lb. which was a little higher than the figure for December but a little under the total for January 1942. On the other hand the 5,833,292 lb. of ammonia liquor produced was higher than the December total also exceeded the January 1942 figure. Sales of sulphate of ammonia exceeded production and there was a lowering in stocks as a result. This was reversed in the case of ammonia liquor where sales of 5,662,416 lb. in January were considerably below those for the preceding month and for the corresponding month of 1942.

Production of plastics which has expanded sharply as a result of war-time needs would be at an even higher rate if raw materials were present in supply sufficient to enable plants to operate at their full capacities.

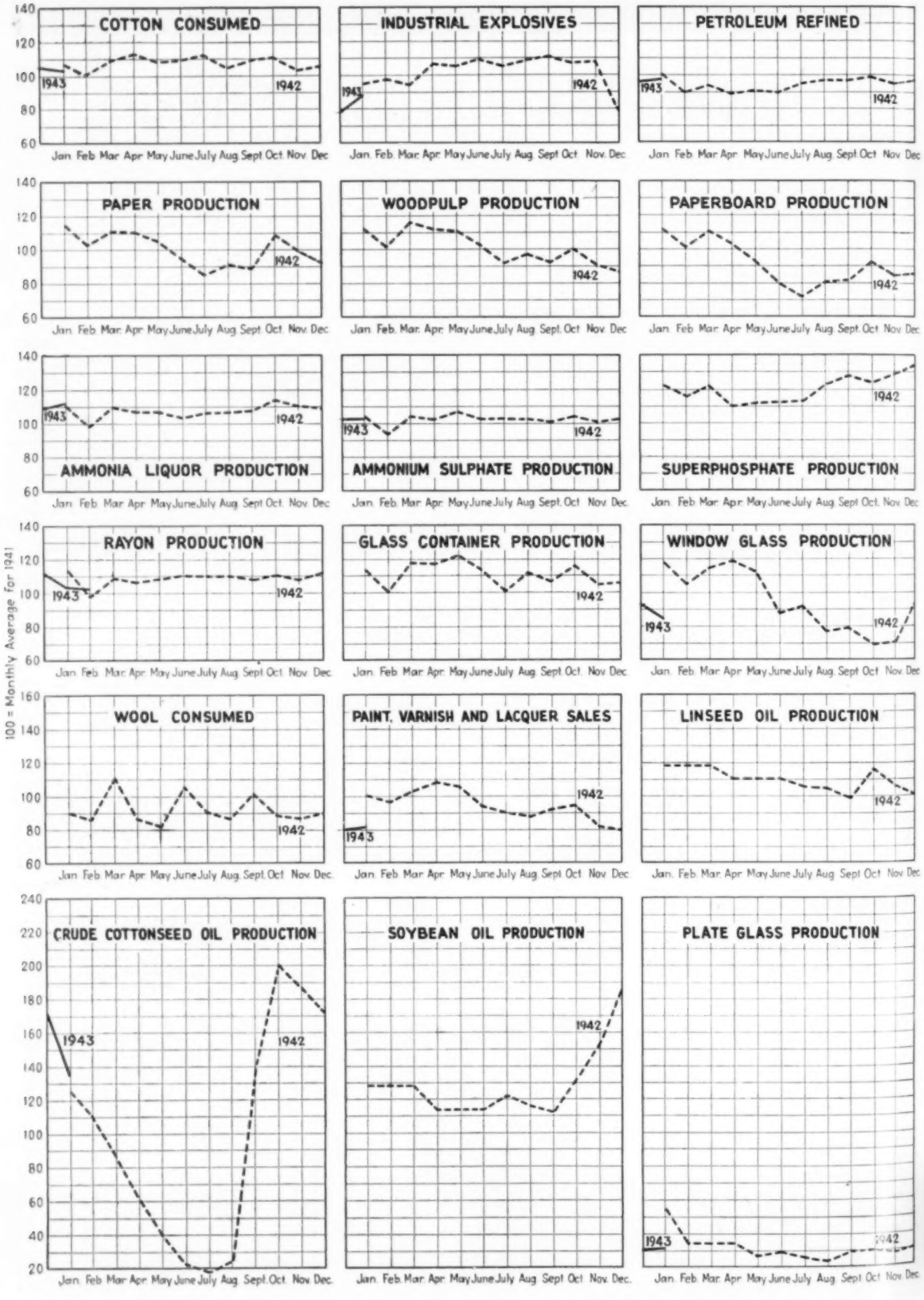
The nitrocellulose situation during February eased somewhat and the same condition probably will continue in March, the Pyroxylin and Vinyl Resin Coated Paper and Fabric Industry Advisory Committee was informed by the Chemicals Division of the War Production Board at a meeting in Washington last month.

Chem. & Met. Index for Industrial Consumption of Chemicals

	Dec. revised	Jan.
Fertilizers	40.30	40.56
Pulp and paper	19.30	20.80
Petroleum refining	14.79	14.82
Glass	16.10	16.30
Paint and varnish	12.06	12.29
Iron and steel	13.60	13.63
Rayon	15.46	14.68
Textiles	11.58	11.48
Coal products	9.52	9.50
Leather	4.70	4.75
Industrial explosives	4.47	4.87
Rubber	3.00	3.00
Plastics	4.50	4.70
	169.38	171.38



Production and Consumption Trends



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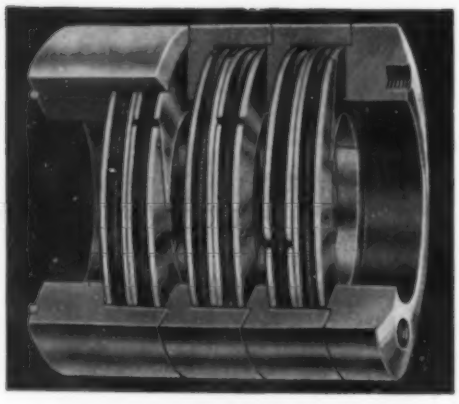

PRIORITY

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LARGER DEMAND FOR CHEMICALS FOR WAR PURPOSES BRINGS GREATER CONTROLS OVER DISTRIBUTION

WHILE A great deal of dissatisfaction has been expressed because of the number of questionnaires which manufacturers have been asked to fill out, the Chemicals Division of WPB has recently declared it important for consumers of chemicals to cooperate with suppliers in furnishing information regarding the use to which the chemicals are being put. The importance of this end-use information rests on the fact that many large tonnage chemicals are finding a steadily increasing market in production of direct war goods which means that control over distribution is being tightened to insure the flow of materials to lines which are essential. This question of government control over the movement of chemicals has been the most important factor in the market for some time and promises to be more important as the year advances. Generally an official regulation is in the nature of a restriction on sales of materials but in the past month the conservation order controlling distribution of silica gel was revoked because the supply had increased sufficiently to take care of all consuming needs even though some of the new producers are not yet in full production.

The program providing for new production of alcohol appears to have made some headway this month as the Chemicals Division of WPB has announced the selection of sites for five new plants to produce alcohol from grain. The sites are Carrollville, Wis., Dubuque and Keokuk, Iowa and Mobile and Peoria, Ill. Productive capacity of the new plants will be 36,000,000 gallons a year on a basis of recovery of feed values for livestock. Incidentally, price control over alcohol was extended to embrace all the formulas where sales involved 50 gallons or upward. A change also was made in the basis of quotations making standard fermentation alcohol, SD2B, 48c a gallon fob works. This grade had been quoted at 50c a gallon but was sold on a delivered basis.

The main development in the fertilizer industry was found in an order placing potash under allocation. Under this order consumers are required to make application for the amount of each potash salt desired, state the purpose for which it is to be used, and report inventories at the beginning of the period. Allocations will be made according to periods with the first including the months of April and May; the second from June 1 to March 31, 1944; and the third applying to April and May 1944.

Improvement in the household fat salvage collections is not as rapid as desired. The amount of government sponsored publicity that came out during February in support of the salvage program is ample evidence that the figures are far from satisfactory. The Office of War Information in different releases called attention to the shortage of glycerine and the urgency of household fat salvage to meet the situation. These were followed by a call for an intensification of the fat salvage campaign and then by an announcement that the frozen food locker operators had been enlisted to act as collectors.

Last month the Soap and Glycerine Industries Advisory Committee met to discuss means of improving glycerine recovery. At this meeting it was announced that further cuts would have to be made in civilian uses of glycerine which are now so low that no appreciable amount can be squeezed out any place. The committee discussed the universal problem of cross hauling and the possibility of establishing zones in which supply and demand would be in balance as was done to control shipments of caustic soda.

The Edible Oil Refining Industry Advisory Committee at a meeting late in February worked on a method of allocation of the nation's edible oil resources to meet the war requirements and civilian needs. The industry was informed through the committee that because of the munitions requirements no glycerine was allocated for the manufacture of shortening during March. A sub-committee of this group is working on specifications of shortening materials for export in which linseed oil is used.

On the last working day of the month Food Distribution Order 14 was amended to set aside 25 percent of the peanut oil production at the refiners to assure a supply adequate for war needs. The actual situation as measured by factory stocks is tight and the trend indicates that it will be tighter.

Serious difficulties of new types are anticipated for the paint and finishes industries. Both drying oil and wax and other imported components of finishes are increasingly scarce. This scarcity may be intensified by the necessary diversion of drying oils to food usage. Such diversion is technically practical, as commercial scale trials indicate linseed oil is a satisfactory component of oils hardened for the manufacture of shortening.

Quotas of drying oils for the pai

CHEM. & MET. Weighed Index of CHEMICAL PRICES

Base=100 for 1937

This month	108.85
Last month	108.89
March, 1942	109.19
March, 1941	99.98

Quotations for spirits of turpentine have been unstable with the net change favoring buyers. Very few changes are noted in the chemical list and prospects favor a continuance of this condition. Higher prices were granted on sales of alcohol on the Pacific Coast.

industry are being tightened under a program announced at the end of February. The industry was urged to make the best possible use of available supplies by reduction of the amount of drying oil in all paints to the lowest workable limit. Official notices about the first of March forecast tighter supply conditions also for casein, synthetic resins, and even containers.

Within a month's time after controls were placed on the distribution and use of vegetable tanning materials, it became apparent that there would be some relaxation in the provisions of the order (M-277). The restrictions, effective February 4, limited the use of many of the imported and domestic vegetable tanning materials to the tanning of sole and other heavy leathers and to the preparation of certain pharmaceutical products and water treatment materials proved very successful. By the first of March preliminary steps had already been taken to ease the restrictions on the use of quebracho wood and urunday.

Besides limiting the uses to which the vegetable tanning material may be put, Order M-277 limits the amount that may be used to the same as that used in 1942. For this purpose the quantities are figured on a quarterly basis and no more than 25 percent of the total amount used in 1942 may be used in any quarter in 1943.

There is no limit put on the amount of material that may be held in inventory. In fact the order specifically exempts the users of vegetable tanning materials from the inventory restrictions of other regulations and orders of the War Production Board.

It's two-way shipping traffic from North Africa, according to official government statements. Through February, ships which took American and British food, clothing and other civilian supplies to the people of the French territorial areas returned to home ports with more than 50,000 tons of raw materials badly needed in this country and England.

The United States is receiving manganese, cobalt ore, cork, tanbark and red squill, among other commodities. Iron ore and phosphate rock are going to Britain. The determination as to what to export and as to allocations of the cargoes is made by the Combined Raw Materials Board.

CHEM. & MET.
Weighed Index of Prices for OILS & FATS

Base=100 for 1937

This month	**145.37**
Last month	143.13
March, 1942	141.32
March, 1941	80.58

The fact that most of the oils are under ceilings, prevents any widespread price movements and market developments have been largely confined to linseed oil which has followed the upward movement of the seed markets. Offerings of most crude oils are limited.

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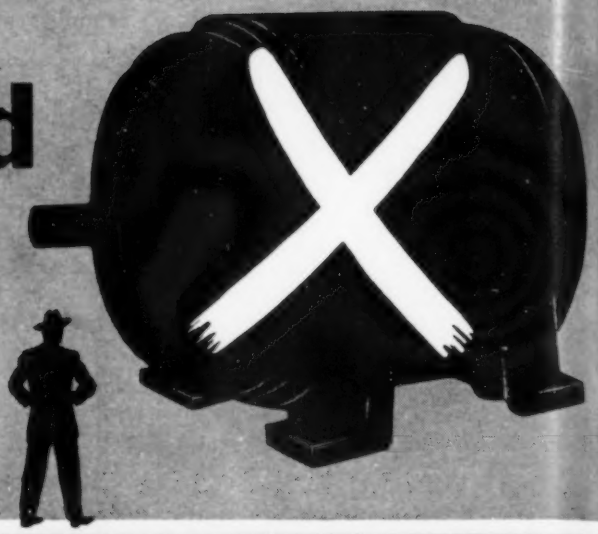

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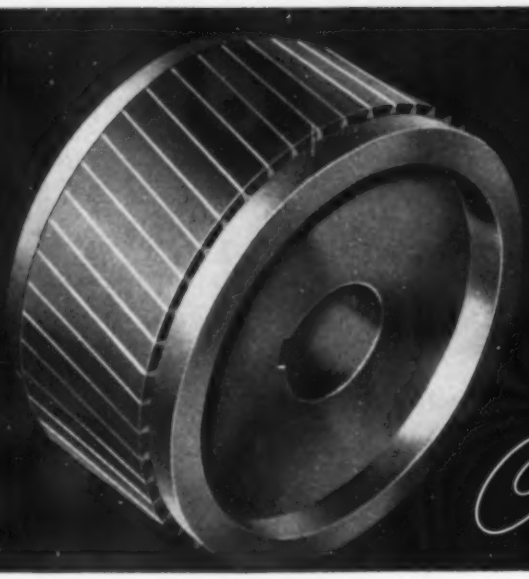

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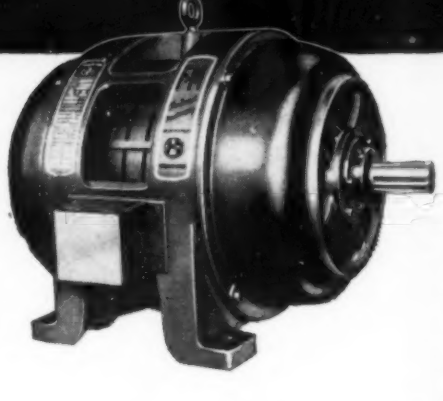

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F M

Motors

CURRENT PRICES

INDUSTRIAL CHEMICALS

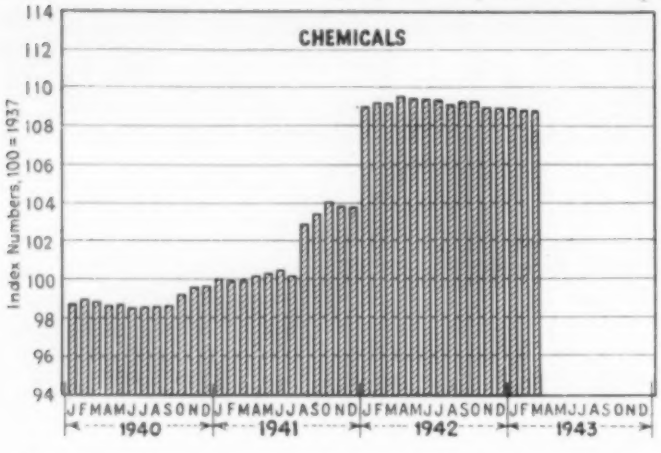
	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.085–$0.109	$0.085–$0.109	$0.168–$0.173
Acid, acetic, 28%, bbl., cwt.	3.38 – 3.63	3.38 – 3.63	3.38 – 3.63
Glacial 99.5%, drums	9.15 – 9.40	9.15 – 9.40	9.15 – 9.40
U. S. P. X 1, 99.5%, dr.	10.95 –11.20	10.95 –11.20	10.95 –11.20
Boric, bbl., ton	109.00–113.00	109.00–113.00	109.00–113.00
Citric, kegs, lb.	.20 – .23	.20 – .23	.20 – .23
Formic, cbys, lb.	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb.	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Hydrofluoric 30% drums, lb.	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb.	.073– .075	.073– .075	.073– .075
Muriatic 18°, tanks, cwt.	1.05 –	1.05 –	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –20.00	18.50 –20.00
Oxalic, crystals, bbl., lb.	.11½– .13	.11½– .13	.11½– .13
Phosphoric, tech., c'bys., lb.	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –	13.00 –	13.00 –
Sulphuric, 66°, tanks, ton	16.50 –	16.50 –	16.50 –
Tannic, tech., bbl., lb.	.71 – .73	.71 – .73	.71 – .73
Tartaric, powd., bbl., lb.	.70 –	.70 –	.70 –
Tungstic, bbl., lb.	nom	nom	nom
Alcohol, amyl			
From Pentane, tanks, lb.	.131–	.131–	.131–
Alcohol, Butyl, tanks, lb.	.12½– .14½	.12½– .14½	.158–
Alcohol, Ethyl, 190 p'f., bbl., gal.	8.19 – 8.25	8.19 – 8.25	8.19 – 8.25
Denatured, 190 proof			
No. 1 special, dr., gal. wks.	.60 –	.60 –	.60 –
Alum, ammonia, lump, bbl., lb.	.03¾– .04	.03½– .04	.03¾– .04
Potash, lump, bbl., lb.	.04 – .04½	.04 – .04½	.04 – .04½
Aluminum sulphate, com. bags, cwt.	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt.	1.85 – 2.10	1.85 – 2.10	1.85 – 2.10
Aqua ammonia, 26°, drums, lb.	.02¼– .03	.02¼– .03	.02¼– .03
tanks, lb.	.02 – .02¼	.02 – .02¼	.02 – .02¼
Ammonia, anhydrous, cyl., lb.	.16 –	.16 –	.16 –
tanks, lb.	.04½–	.04½–	.04½–
Ammonium carbonate,powd.tech., casks, lb.	.09½– .12	.09½– .12	.09½– .12
Sulphate, wks., ton	29.20 –	29.20 –	29.00 –
Amylacetate tech., from pentane, tanks, lb.	.145–	.145–	.145–
Antimony Oxide, bbl., lb.	.15 –	.15 –	.15 –
Arsenic, white, powd., bbl., lb.	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb.	nom	nom	nom
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	60.00 –65.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb.	.11 – .12	.11 – .12	.10½– .11
Blanc fix, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt.	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35
Borax, gran., bags, ton	44.00 –	44.00 –	44.00 –
Bromine, cs., lb.	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –	3.00 –	3.00 –
Arsenate, dr., lb.	.07 – .08	.07 – .08	.07 – .08
Carbide drums, lb.	.04½– .05	.04½– .05	.04½– .05
Chloride, fused, dr., del., ton	18.00 –24.00	18.00 –24.00	19.00 –24.50
flake, bags., del., ton	18.50 –25.00	18.50 –25.00	20.50 –25.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb.	.05½–	.05½–	.05½–
Tetrachloride drums, gal.	.73 – .80	.73 – .80	.73 – .80
Chlorine,liquid,tanks, wks., 100 lb.	2.00 –	2.00 –	2.00 –
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb.	.18 – .20	.18 – .20	.18 – .20
Sulphate, bbl., cwt.	5.15 – 5.40	5.15 – 5.40	5.15 – 5.40
Cream of tartar, bbl., lb.	.57 –	.57 –	.57 –
Diethylene glycol, dr., lb.	.14 – .15½	.14 – .15½	.14 – .15½
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Ethyl acetate, drums, lb.	.12 –	.12 –	.12 –
Formaldehyde, 40%, bbl., lb.	.05½– .06	.05½– .06¼	.05½– .06
Furfural, tanks, lb.	.09 –	.09 –	.09 –
Fusel o.l, drums, lb.	.18 – .19	.18 – .19	.18 – .19
Glaubers salt, bags, cwt.	1.05 – 1.10	1.05 – 1.10	1.05 – 1.10
Glycerine, c.p., drums, extra, lb.	.18¼–	.18¼–	.18¼–
Lead:			
White, basic carbonate, dry casks, lb.	.08½–	.08½–	.08½–
White, basic sulphate, sck., lb.	.07½–	.07½–	.07½–
Red, dry, sck., lb.	.09½–	.09½–	.09½–
Lead acetate, white crys., bbl., lb.	.12½– .13	.12½– .13	.12 – .13
Lead arsenate, powd., bag, lb.	.11 – .12	.11 – .12	.11 – .12
Lime, chem., bulk, ton	8.50 –	8.50 –	8.50 –
Litharge, powd., csk., lb.	.08½–	.08½–	.08½–
Lithopone, bags, lb.	.04½– .04¾	.04½– .04¾	.04½– .04¾
Magnesium carb., tech., bags, lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Methanol, 95%, tanks, gal.	.58 –	.58 –	.60 –
97%, tanks, gal.	.58 –	.58 –	.60 –
Synthetic, tanks, gal.	.28 –	.28 –	.28 –
Nickel salt, double, bbl., lb.	.13¼– .13½	.13¼– .13½	.13¼– .13½
Orange mineral, csk., lb.	.12½–	.12½–	.12½–
Phosphorus, red, cases, lb.	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb.	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb.	.09½– .10	.09½– .10	.09½– .10
Carbonate, 80–85%,calc.csk.,lb.	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb.	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Muriate, 60% bags, unit	.53½–	.53½–	.53½–
Nitrate, bbl., lb.	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.19½– .20	.19½– .20	.19½– .20
Prussiate, yellow, casks, lb.	.17 – .18	.17 – .18	.17 – .18
Sal ammoniac, white, casks, lb.	.0515– .06	.0515– .06	.0515– .06
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –	17.00 –	17.00 –
Soda ash, light, 58%, bags, contract, cwt.	1.05 –	1.05 –	1.05 –
Dense, bags, cwt.	1.10 –	1.10 –	1.10 –
Soda, caustic, 76%, solid, drums, cwt.	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Bicarbonate, bbl., cwt.	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb.	.07½– .08	.07½– .08	.07½– .08
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	16.00 –17.00
Bisulphite, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Cyanide, cases, dom., lb.	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb.	.08 – .09	.08 – .09	.08 – .09
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.50 – 2.65	2.50 – 2.65	2.50 – 2.65
Nitrate, bulk, cwt.	1.35 –	1.35 –	1.35 –
Nitrite, casks, lb.	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb.	2.70 –	2.70 –	2.70 –
Prussiate, yel. drums, lb.	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.), wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb.	.03 – .03½	.03 – .03½	.03 – .03½
Sulphite, crys., bbl., lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton	16.00 –	16.00 –	16.00 –
Chloride, dr., lb.	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb.	.07 – .08	.07 – .08	.07 – .08
Flour, bag, cwt.	1.90 – 2.40	1.90 – 2.40	1.90 – 2.40
Tin Oxide, bbl., lb.	.55 –	.55 –	.55 –
Crystals, bbl., lb.	.39½–	.39½–	.39½–
Zinc, chloride, gran., bbl., lb.	.05½– .06	.05½– .06	.05 – .06
Carbonate, bbl., lb.	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb.	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb.	.10½–	.10½–	.09½–
Zinc oxide, lead free, bag, lb.	.07¼–	.07¼–	.07¼–
5% leaded, bags, lb.	.07¼–	.07¼–	.07¼–
Sulphate, bbl., cwt.	3.85 – 4.00	3.85 – 4.00	3.40 – 3.50

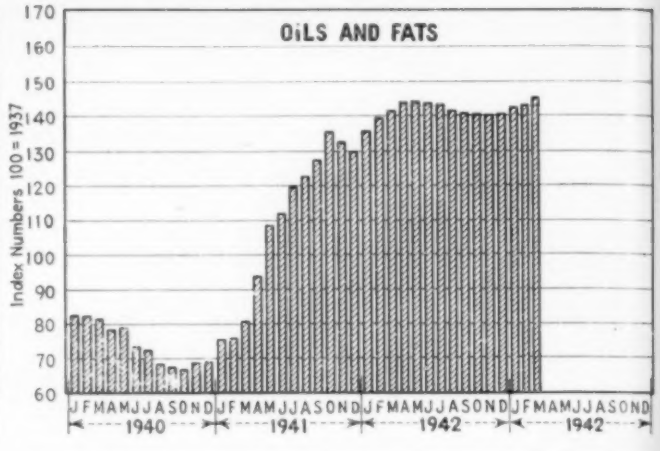
OILS AND FATS

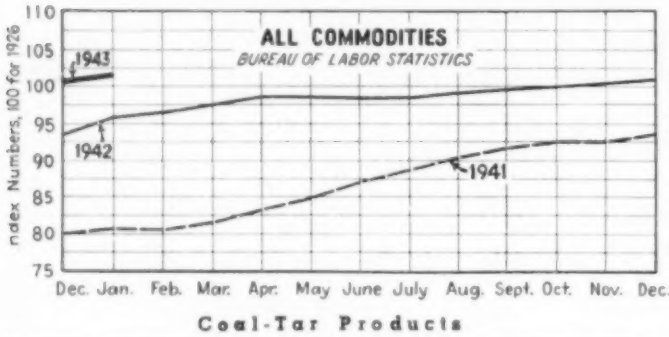
	Current Price	Last Month	Last Year
Castor oil, No. 3 bbl., lb.	$0.13¾–$0.14½	$0.13¾–$0.14½	$0.13¾–$0.14½
Chinawood oil, bbl., lb.	.38 –	.38 –	.38 –
Coconut oil, Ceylon, tank, N. Y., lb.	nom	nom	nom
Corn oil crude, tanks (f.o.b. mill), lb.	.12¼–	.12¼–	.12¼–
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.12¾–	.12¾–	.12½–
Linseed oil, raw car lots, bbl., lb.	.152–	.14 –	.125–
Palm, casks, lb.	.09 –	.09 –	.09 –
Peanut oil, crude, tanks (mill), lb.	.13 –	.13 –	.13 –
Rapeseed oil, refined, bbl., lb.	nom	nom	nom
Soya bean, tank, lb.	.11¼–	.11¼–	.11¼–
Sulphur (olive foots), bbl., lb.	nom	nom	.19 –
Cod, Newfoundland, bbl., gal.	nom	nom	nom
Menhaden, light pressed, bbl., lb.	.117–	.117–	.112–
Crude, tanks (f.o.b. factory) lb.	.088–	.088–	.08 –
Grease, yellow, loose, lb.	.08½–	.08½–	.09295
Oleo stearine, lb.	.09½–	.09½–	.09½–
Oleo oil, No. 1	.11½–	.11½–	.11½–
Red oil, distilled, dp.p. bbl., lb.	.11½–	.11–¼	.12 –
Tallow extra, loose, lb.	.08¼–	.08¼–	.097125

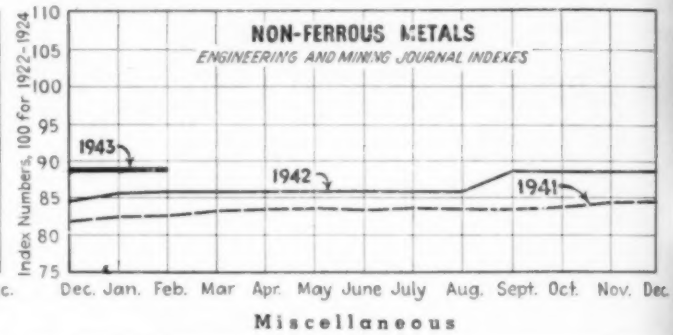
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to March 15

Chem. & Met.'s Weighted Price Indexes








NON-FERROUS METALS
ENGINEERING AND MINING JOURNAL INDEXES
Index Numbers, 100 for 1922-1924
1943
1942
1941
Dec. Jan. Feb. Mar Apr. May June July Aug. Sept. Oct. Nov. Dec.

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52- $0.55	$0.52- $0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb.	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb.	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal.	.15 -	.15 -	.14 -
Beta-naphthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.11 -	.11 - .11	.10½- .11
Cresylic acid, dr., wks., gal.	.81 - .83	.81 - .83	.81 - .83
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb.	.18 - .19	.18 - .19	.18 - .19
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 -	.60 -	.70 -
H-acid, bbl., lb.	.45 - .50	.45 - .50	.45 - .50
Naphthalene, flake, bbl., lb.	.07 - .07½	.07 - .07½	.07 - .07½
Nitrobenzene, dr., lb.	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb.	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums, lb.	.10½- .11	.10½- .11	.13 -
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal.	1.70 - 1.80	1.70 - 1.80	1.70 - 1.80
Resorcinol, tech., kegs., lb.	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb.	.33 - .40	.33 - .40	.33 - .40
Solvent naphtha, w.w., tanks, gal.	.27 -	.27 -	.27 -
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal.	.33 -	.33 -	.32 -
Xylol, com., tanks, gal.	.26 -	.26 -	.26 -

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.19 - .20	.19 - .20	.19½- .25
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335- .30	.0335- .30	.0335- .30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb.	.11 - .26	.11 - .26	.11 - .26
Chrome green, bbl., lb.	.21½- .30	.21½- .30	.21½- .30
Carmine, red, tins, lb.	4.60 - 4.75	4.60 - 4.75	4.60 - 4.75
Para toner, lb.	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb.	3.05 - 3.10	3.05 - 3.10	3.05 - 3.10
Chrome yellow, C.P., bbl., lb.	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 - .10	.08 - .10	.08 - .10
Gum copal Congo, bags, lb.	.09 - .30	.09 - .30	.09 - .30
Manila, bags, lb.	.09 - .15	.09 - .14	.09 - .15
Demar, Batavia, cases, lb.	.10 - .22	.10 - .20	.10 - .22
Kauri, cases, lb.	.18 - .60	.17 - .60	.18 - .60
Kieselguhr (f.o.b. mines), ton.	7.00 -40.00	7.00 -40.00	7.00 -40.00
Magnesite, calc, ton	64.00 -	64.00 -	64.00 -
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	nom	nom	nom
Rosin, H., 100 lb.	4.15 -	4.10 -	3.83 -
Turpentine, gal.	.69 -	.70 -	.80½-
Shellac, orange, fine, bags, lb.	.39 -	.39 -	.43 -
Bleached, bonedry, bags, lb.	.39 -	.39 -	.40 -
T. N. bags, lb.	.31 -	.31 -	.32 -
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
200 mesh (f.o.b. Ga.), ton.	6.00 - 8.00	6.00 - 8.00	6.00 - 8.00

Industrial Notes

THE BRISTOL CO., Waterbury, has appointed Harry E. Beane sales manager and E. L. Stilson assistant sales manager.

MITCHELL-BRADFORD CHEMICAL CO., Bridgeport, Conn., is now represented in Michigan and the West by H. Tom Collard of Protective Coatings, Inc., Detroit. Mr. Collard is assisted by Harold Forton of Paramount Rubber Co., Detroit, as technical engineer.

COPPERWELD STEEL CO., Warren, Ohio, has appointed F. D. Jones assistant advertising manager for the company's Warren division.

HANDY & HARMAN, New York, have opened an office at 1206 South Maple Ave., Los Angeles with H. A. Folgner in charge.

WICKWIRE SPENCER STEEL CO., New York, announces that Wilfred C. Shattuck has rejoined the company and will act as wire sales manager with headquarters in the New York office.

WESTINGHOUSE ELECTRIC AND MFG. CO., East Pittsburgh, has transferred Henry D. Moreland from X-ray division manager at Portland, Ore., to East Pittsburgh where he will serve as manager of X-ray products, agency and specialties department.

THE FILTER PAPER CO., Chicago, has been dissolved as a corporation and business is being continued by the owners, Hyman D. Buckner and Charles Miller, under a partnership arrangement.

UNITED STATES STEEL SUPPLY CO., Chicago, formerly the Scully Steel Products Co., has appointed F. M. Beaudoin employment manager.

DETROIT REX PRODUCTS CO., Detroit, has opened new regional offices at 2308 4th Ave., Birmingham, Ala. Wm. A. Vensel has been transferred from Los Angeles to act as southern regional manager. Ernest N. Taylor has been advanced to acting manager of the western region with headquarters at 1166 West Cermak Road, Chicago.

FOOTE BROS. GEAR & MACHINE CORP., Chicago, has moved B. H. Quackenbush from the contract division to serve as assistant sales manager.

PITTSBURGH DES MOINES STEEL CO., Pittsburgh, has named William R. Jackson secretary-treasurer to succeed George A. Smith who has retired after forty-four years of active service with the company.

TEMPLETON, KENLY & CO., Chicago, has named Charles A. Crane assistant to J. B. Templeton president of the company.

MINERALS SEPARATION NORTH AMERICAN CORP., New York, has acquired the business and assets of Phosphate Recovery Corp. and will continue this business from its main office and from the laboratories at Lakeland, Fla. and Hibbing, Minn.

This "Carrot" means healthy metals

YOU CAN SEE why metalworkers call this lump of calcium metal a "carrot." This is the way it looks when it comes from an electrolytic cell in which it is made.

Calcium is a soft, silvery-looking metal. Although it is abundantly present in such common materials as chalk and limestone, its recovery as a pure metal is extremely difficult. Yet it is vitally essential to this country.

In the making of stainless or high-alloy steels, calcium drives out impurities, giving cleaner, better steel for casting or rolling. In magnesium casting, small amounts of calcium improve the finish of the surface and minimize scaling. Calcium is an essential in the making of many metals.

This hitherto rare metal has been made in this country only during the past few years. Before Europe exploded, the United States was dependent upon France as a source of supply.

But back as far as 1935, thinking that this country should have a domestic source, ELECTRO METALLURGICAL COMPANY, a unit of UCC, started a major research program. After four years of work . . . as French supplies dwindled . . . a plant was put into operation for the manufacture of the gray metal. Today, ELECTRO METALLURGICAL COMPANY produces many times as much calcium metal as this country ever imported . . . and production is increasing.

UNION CARBIDE AND CARBON CORPORATION

UCC

30 East 42nd Street — New York, N. Y.

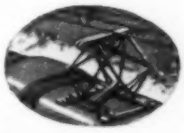
Principal Products

ALLOYS AND METALS
ELECTRODES, CARBONS AND BATTERIES
INDUSTRIAL GASES AND CARBIDE
CHEMICALS — PLASTICS

IN THE AIR SOONER! Vital aircraft parts flow from production lines quicker because the use of calcium metal results in better metal.

BETTER HEALTH! Pure calcium metal is used as a drying and purifying agent in the manufacture of certain new disease-fighting drugs.

CHEMICAL HELPER! Calcium is necessary in making a number of rare metals—many of which heretofore were unavailable commercially—and all of which are vital.



METAL-SAVER! In the melting of copper scrap for use in certain types of electrical equipment, calcium is used as a purifier and a restorer of electrical conductivity.

BUY UNITED STATES WAR BONDS AND STAMPS

NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$40,000	$80,000	$160,000
Middle Atlantic	$9,650,000	1,540,000	9,890,000	90,000
South	1,848,000	3,500,000	1,888,000	100,000
Middle West	5,080,000	600,000	8,410,000	7,805,000
West of Mississippi	3,800,000	1,130,000	4,920,000	5,390,000
Far West	40,000	6,200,000	280,000	6,200,000
Canada	.....	817,000	3,185,000	.....
	$20,418,000	$13,827,000	$28,653,000	$19,745,000

PROPOSED WORK

California—Air Reduction Sales Co., 60 East 42nd St., New York, N. Y., plans the construction of additional plant facilities. Estimated cost $40,000.

Illinois—Defense Plant Corporation, 811 Vermont Ave., N. W., Washington, D. C., plans the construction of a rubber plant. Estimated cost $5,000,000.

Ill., Rock Island — Schenley Distillers, Inc., 26 East 6th St., Cincinnati, O., is having plans prepared for the construction of an industrial alcohol plant.

Kentucky—National Carbon Co., 60 East 42nd St., New York, N. Y., plans to construct a plant here. Project will be financed by Defense Plant Corp. Estimated cost $280,000.

Kentucky—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., plans the construction of additional plant facilities here to be operated by National Distillers Products Corp., 120 Broadway, New York, N. Y. Estimated cost $118,000.

Mo., St. Louis—Hammer Dry Plate & Film Co., D. Craig Dailey, Press., 3547 Ohio Ave., manufacturer of film and dry plates for photographic and offset printing, contemplates reconstructing portions of its plant recently destroyed by fire. Estimated cost $100,000.

New Jersey—New Jersey Powder Co., 15 Broad St., New York, N. Y., plans to construct additional plant facilities here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $9,650,000.

North Carolina—National Carbon Co., Inc., 30 East 42nd St., New York, N. Y., plans to construct additional plant facilities. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $1,450,000.

Ohio., Parral—(Mail Strasburg)—Robinson Clay Products Co., Second National Bank, Akron, plans the construction of a tunnel kiln. Estimated cost $40,000.

Texas — Consolidated Chemical Industries, Inc., Esperson Bldg., Houston, plans the construction of a plant to be financed by U. S. Government, Washington, D. C. Chemical Construction Corp., 30 Rockefeller Plaza, New York, N. Y., Engrs. Estimated cost $1,000,000.

Texas—Monsanto Chemical Co., Texas City, plans the construction of additional plant facilities to be financed by Defense Plant Corp., Washington, D. C. Estimated cost $2,000,000.

Texas—Southern Acid & Sulphur Co., Inc., Rialto Bldg., St. Louis, Mo., plans to construct plant facilities here to be financed by Defense Plant Corp., Washington, D. C. Estimated cost $700,000.

CONTRACTS AWARDED

Alabama—Reynolds Alloys Corp., Sheffield, Ala., has awarded the contract for the construction of a plant to Andrew Weston Co., 7 East 42nd St., New York, N. Y. Estimated cost $3,500,000.

California—Standard Oil Co. of California, 605 West Olympic St., Los Angeles, has awarded the contract for the construction of a plant to Bechtel-McCone-Parsons Corp., 601 West 5th St., Los Angeles. Estimated cost $6,200,000.

Conn., Stratford — Raybestos Division, Raybestos Manhattan, Inc., 75 East Main St., has awarded the contract for the construction of a 1 story, 52x125 ft. warehouse to O. E. Burghart, Inc., 155 Island Brook Ave., Bridgeport.

Iowa—Defense Plant Corporation, 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the construction of an alcohol plant to be operated by the Grain Processing Corp. to the Weitz Co., Inc., 406 Fleming Bldg., Des Moines. Estimated cost $1,000,000.

N. J., Jersey City—Colgate-Palmolive-Peet Co., 105 Hudson St., Jersey City, has awarded the contract for the construction of a manufacturing plant to Charles Christensen & Son, 921 Bergen Ave. Estimated cost $40,000.

Ohio, Lorain—Brush Berryllium Co., Lorain, has awarded the contract for the construction of a plant to H. K. Ferguson Co., Hanna Bldg., Cleveland. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $600,000.

Okla., Enid—Champlin Oil Refining Co., Enid, plans to rebuild its oil refinery. Work will be done by lay labor.

Pa., Erie—Interlake Iron Corp., Perry Furnace Co., J. W. McLaughlin, Supt., foot Wayne St., has awarded the contract for the construction of a battery of 35 coke ovens to Wilputte Coke Oven Corp., 40 Rector St., New York, N. Y. Estimated cost $1,500,000.

Tex., Midland—Gulf Oil Corp., Petroleum Bldg., Fort Worth, plans the construction of an oil and gasoline and byproducts wholesale plant, steel tanks, loading racks, etc. Work will be done by owner. Estimated cost $90,000.

B. C., Vancouver—Canadian Liquid Air Co., Ltd., Beaver Hall Hill, Montreal, Que., has awarded the contract for the construction of an acetylene plant and installation of equipment to Allan & Vimer Construction Co., Ltd., 602 North Hastings St., Vancouver. Estimated cost $127,000.

Ont., Hamilton—Hamilton Harbor Commission, 21 Main St., E., has awarded the contract for altering and equipping a plant for vegetable oil extraction to Russell Construction Co., Ltd., 501 Harbor Comn. Bldg., Toronto. Estimated cost $580,295.

Ont., Niagara Falls—Canadian Carborundum Co., Ltd., Stanley St., has awarded the contract for the construction of a mixing and aggregate storage building to Atlas Construction Co., Ltd., 679 Belmont St., Montreal, Que. Estimated cost $60,000.

Que., Cap de la Madeleine—Dominion Rubber Co., Ltd., 550 Paineau Ave., Montreal, has awarded the contract for reconstructing its plant to Ryan, Ltd., 1808 William St., Montreal. Estimated cost $50,000.